DOE/EIS-0402
November 2018

Final Environmental Impact Statement for Remediation of Area IV and the Northern Buffer Zone of the Santa Susana Field Laboratory

Summary

U.S. Department of Energy
Office of Environmental Management

AVAILABILITY OF THE
FINAL ENVIRONMENTAL IMPACT STATEMENT FOR REMEDIATION OF AREA IV AND THE NORTHERN BUFFER ZONE OF THE SANTA SUSANA FIELD LABORATORY (SSFL Area IV EIS)

For further information on this *Final SSFL Area IV EIS,* or to request a copy, please contact:

Ms. Stephanie Jennings, NEPA Document Manager
SSFL Area IV EIS
U.S. Department of Energy
4100 Guardian Street, Suite 160
Simi Valley, CA 93063
Telephone: 1-805-842-3864

Printed with soy ink on recycled paper

COVER SHEET

Lead Agency: U.S. Department of Energy (DOE), Office of Environmental Management

Cooperating Agencies: National Aeronautics and Space Administration (NASA), U.S. Army Corps of Engineers, and the Santa Ynez Band of Chumash Indians

Title: *Final Environmental Impact Statement for Remediation of Area IV and the Northern Buffer Zone of the Santa Susana Field Laboratory (Final SSFL Area IV EIS)* (DOE/EIS-0402)

Location: Ventura County, California

For further information or for copies of this Final SSFL Area IV EIS, contact:

Ms. Stephanie Jennings
NEPA Document Manager
SSFL Area IV EIS
U.S. Department of Energy
4100 Guardian Street, Suite 160
Simi Valley, CA 93063
Telephone: 1-805-842-3864

For general information on the DOE National Environmental Policy Act (NEPA) process, contact:

Catherine Bohan
NEPA Compliance Officer
Office of Environmental Management
U.S. Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585-0103
Telephone: 301-903-9546

This document is available on the DOE NEPA website (http://energy.gov/nepa) for viewing and downloading.

Abstract:

This *Final SSFL Area IV EIS* analyzes the potential environmental impacts of alternatives for conducting cleanup activities in Area IV of the Santa Susana Field Laboratory (SSFL) and the adjoining Northern Buffer Zone (NBZ), located in Ventura County, California. Remediation is needed to clean up residual chemicals and radionuclides from historical DOE operations at the Energy Technology Engineering Center (ETEC) in Area IV, in compliance with laws, regulations, orders, and agreements. The alternatives analyzed in this environmental impact statement (EIS) involve the disposition of remaining DOE facilities and support buildings, remediation of soil and groundwater, and disposal of all resulting materials at existing licensed or permitted facilities in a manner that is protective of the environment and the health and safety of the public and workers. The information in this EIS will inform decision-makers and the public about the potential impacts of the proposed cleanup of both chemicals and radionuclides and will be considered along with other relevant factors in making decisions regarding cleanup of Area IV and the adjoining NBZ. DOE is proposing three sets of alternatives. Each set was developed to address a component of the SSFL Area IV and NBZ cleanup effort: soil remediation, building demolition, and groundwater remediation.

Preferred Alternative: DOE's preferred alternative for soils remediation is the Conservation of Natural Resources, Open Space Scenario. DOE is identifying this as the preferred alternative because it would be consistent with the risk assessment approach typically used at other DOE sites, other California Department of Toxic Substances Control- (DTSC-) regulated sites, and U.S. Environmental Protection Agency (EPA) Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) sites, which accounts for the specific future land use of the site. Use of a risk assessment

approach would be consistent with the process being used by Boeing for the land it owns at SSFL and recognizes the Grant Deeds of Conservation Easement and Agreements that commit Boeing's SSFL property, including Area IV and the NBZ, to remaining as open space. This scenario would use a CERCLA risk assessment approach that would be protective of human health and the environment rather than look-up table values (action levels). The 2010 *Administrative Order on Consent for Remedial Action* (AOC) between DOE and the DTSC allows DOE and DTSC to agree upon changes to the AOC to better meet cleanup objectives. DOE expects to engage DTSC in discussions about such changes in order to implement this soil remediation alternative.

For building demolition, DOE's preferred alternative is the Building Removal Alternative. Under this alternative DOE would demolish the 18 DOE-owned buildings in Area IV and transport the resulting waste off site for disposal. Demolition of thirteen facilities and disposition of the resulting debris would be in accordance with DOE requirements and applicable laws and regulations. Three facilities at the Radioactive Materials Handling Facility (RMHF) and the two facilities comprising the Hazardous Waste Management Facility would be closed in accordance with DTSC-approved Resource Conservation and Recovery Act (RCRA) facility closure plans.

DOE's preferred alternative for groundwater remediation is a combination of the Treatment Alternative and the Monitored Natural Attenuation Alternative. DOE would treat the groundwater plumes with higher concentrations of contaminants (the Former Sodium Disposal Facility, Hazardous Materials Storage Area, Building 4100/56, and Building 4057 plumes) in accordance with the results of the final RCRA Groundwater Corrective Measures Study. Source removal is the preferred alternative for the strontium-90 source. Monitored natural attenuation would be used for plumes that are not amenable to active treatment – the two plumes with the lowest concentrations of trichloroethylene (the Metals Clarifier and RMHF plumes) and the tritium plume. DOE's proposed groundwater remedial actions would be included in the final Corrective Measures Study submitted to DTSC for approval.

Public Involvement:

DOE conducted a number of activities to encourage public input and assist the public in its role in the NEPA process. Following issuance of an Advance Notice of Intent to prepare a draft EIS in October 2007 (72 *Federal Register* [FR] 58834), DOE held informal discussions with the public and stakeholders to gather information used in preparing the Notice of Intent (NOI) published in May 2008 (73 FR 28437). During this first scoping period, DOE held six scoping public meetings to present the proposed alternatives and receive comments from agencies, organizations, and the public. DOE held scoping meetings in Simi Valley, Northridge, and Sacramento, California. In spring 2012, DOE sponsored three Community Alternative Development Workshops, in which community members were asked to articulate their preferences for alternatives that they would like to see included in this EIS. In consideration of site characterization activities conducted by DOE and the EPA and changes in cleanup requirements (as a result of the 2010 AOC), DOE published an Amended NOI in February 2014 (79 FR 7439), announcing a second scoping period from February to April 2014. During this second scoping period, DOE held two public scoping meetings, one each in Simi Valley and Agoura Hills, California, and a scoping meeting with Native American tribal members. DOE considered comments provided during both scoping periods, as well as input received from the 2012 Community Alternatives Development Workshops, in the preparation of the draft EIS.

In preparing this *Final SSFL Area IV EIS*, DOE considered comments received during the public comment period on the *Draft SSFL Area IV EIS* (January 13 through March 14, 2017) and late comments received after the close of the public comment period. Public hearings on the *Draft SSFL Area IV EIS* were held in Simi Valley, California and Van Nuys, California and a meeting with Native American tribal members was held in Simi Valley, California. DOE considered every comment received

at the public hearings and by U.S. mail, email, and through the website during preparation of this *Final SSFL Area IV EIS*.

This *Final SSFL Area IV EIS* contains revisions and new information based in part on comments received on the *Draft SSFL Area IV EIS*. Volume 3 contains the comments received on the *Draft SSFL Area IV EIS* and DOE's responses to the comments. DOE will use the analysis presented in this *Final SSFL Area IV EIS*, as well as other information, in preparing one or more Records of Decision (RODs) regarding cleanup activities in Area IV of the SSFL and the adjoining NBZ. DOE will is ROD(s) no sooner than 30 days after the U.S. Environmental Protection Agency publishes a Notice of Availability of this *Final SSFL Area IV EIS* in the *Federal Register*.

This page left blank intentionally

Table of Contents

List of Figures

List of Tables

Acronyms and Abbreviations

AEC	Atomic Energy Commission
ALARA	as low as reasonably achievable
AOC	*Administrative Order on Consent for Remedial Action*
BMP	best management practice
Boeing	The Boeing Company
BTV	Background Threshold Value
CEQ	Council on Environmental Quality
CEQA	California Environmental Quality Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	*Code of Federal Regulations*
CFWS	California Fish and Wildlife Service
CMWD	Calleguas Municipal Water District
CNEL	community noise equivalent level
CO	*Consent Order for Corrective Action*
CO_2	carbon dioxide
dBA	decibels A-weighted
D&D	decontamination and decommissioning
DOE	U.S. Department of Energy
DTSC	Department of Toxic Substances Control
EA	environmental assessment
EIR	environmental impact report
EIS	environmental impact statement
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
ESAL	equivalent single-axle load
ETEC	Energy Technology Engineering Center
FAL	field action level
FONSI	Finding of No Significant Impact
FR	*Federal Register*
FSDF	Former Sodium Disposal Facility
HMSA	Hazardous Materials Storage Area
HWMF	Hazardous Waste Management Facility
LCF	latent cancer fatality
LLW	low-level radioactive waste
LOS	level of service
LUT	Look-Up Table
MCL	maximum contaminant level
MDC	minimum detectable concentration
MLLW	mixed low-level radioactive waste
NAAQS	National Ambient Air Quality Standards
NASA	National Aeronautics and Space Administration
NBZ	Northern Buffer Zone
NEPA	National Environmental Policy Act
NNSS	Nevada National Security Site
NOI	Notice of Intent
NO_X	nitrogen oxides
NPDES	National Pollutant Discharge Elimination System

NRHP	*National Register of Historic Places*
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PCE	perchloroethylene
$PM_{2.5}$	particulate matter less than 2.5 microns in diameter
PM_{10}	particulate matter less than 10 microns in diameter
RBSL	risk-based screening level
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
RMHF	Radioactive Materials Handling Facility
ROD	Record of Decision
ROI	region of influence
SHPO	State Historic Preservation Officer
SRAIP	Soils Remedial Action Implementation Plan
SRAM	*Final Standardized Risk Assessment Methodology Revision 2 Addendum, Santa Susana Field Laboratory, Ventura County, California*
SRE	Sodium Reactor Experiment
SSFL	Santa Susana Field Laboratory
SO_2	sulfur dioxide
TCE	trichloroethylene
TPH	total petroleum hydrocarbons
USFWS	U.S. Fish and Wildlife Service
WCS`	Waste Control Specialists

CONVERSIONS

METRIC TO ENGLISH			ENGLISH TO METRIC		
Multiply	**by**	**To get**	**Multiply**	**by**	**To get**
Area					
Square meters	10.764	Square feet	Square feet	0.092903	Square meters
Square kilometers	247.1	Acres	Acres	0.0040469	Square kilometers
Square kilometers	0.3861	Square miles	Square miles	2.59	Square kilometers
Hectares	2.471	Acres	Acres	0.40469	Hectares
Concentration					
Kilograms/square meter	0.16667	Tons/acre	Tons/acre	0.5999	Kilograms/square meter
Milligrams/liter	1 [a]	Parts/million	Parts/million	1 [a]	Milligrams/liter
Micrograms/liter	1 [a]	Parts/billion	Parts/billion	1 [a]	Micrograms/liter
Micrograms/cubic meter	1 [a]	Parts/trillion	Parts/trillion	1 [a]	Micrograms/cubic meter
Density					
Grams/cubic centimeter	62.428	Pounds/cubic feet	Pounds/cubic feet	0.016018	Grams/cubic centimeter
Grams/cubic meter	0.0000624	Pounds/cubic feet	Pounds/cubic feet	16,018.5	Grams/cubic meter
Length					
Centimeters	0.3937	Inches	Inches	2.54	Centimeters
Meters	3.2808	Feet	Feet	0.3048	Meters
Kilometers	0.62137	Miles	Miles	1.6093	Kilometers
Radiation					
Sieverts	100	Rem	Rem	0.01	Sieverts
Temperature					
Absolute					
Degrees C + 17.78	1.8	Degrees F	Degrees F - 32	0.55556	Degrees C
Relative					
Degrees C	1.8	Degrees F	Degrees F	0.55556	Degrees C
Velocity/Rate					
Cubic meters/second	2118.9	Cubic feet/minute	Cubic feet/minute	0.00047195	Cubic meters/second
Grams/second	7.9366	Pounds/hour	Pounds/hour	0.126	Grams/second
Meters/second	2.237	Miles/hour	Miles/hour	0.44704	Meters/second
Volume					
Liters	0.26418	Gallons	Gallons	3.7854	Liters
Liters	0.035316	Cubic feet	Cubic feet	28.316	Liters
Liters	0.001308	Cubic yards	Cubic yards	764.54	Liters
Cubic meters	264.17	Gallons	Gallons	0.0037854	Cubic meters
Cubic meters	35.314	Cubic feet	Cubic feet	0.028317	Cubic meters
Cubic meters	1.3079	Cubic yards	Cubic yards	0.76456	Cubic meters
Cubic meters	0.0008107	Acre-feet	Acre-feet	1233.49	Cubic meters
Weight/Mass					
Grams	0.035274	Ounces	Ounces	28.35	Grams
Kilograms	2.2046	Pounds	Pounds	0.45359	Kilograms
Kilograms	0.0011023	Tons (short)	Tons (short)	907.18	Kilograms
Metric tons	1.1023	Tons (short)	Tons (short)	0.90718	Metric tons

ENGLISH TO ENGLISH					
Acre-feet	325,850.7	Gallons	Gallons	0.000003046	Acre-feet
Acres	43,560	Square feet	Square feet	0.000022957	Acres
Square miles	640	Acres	Acres	0.0015625	Square miles

a. This conversion is only valid for concentrations of contaminants (or other materials) in water.

METRIC PREFIXES

Prefix	Symbol	Multiplication factor
exa-	E	1,000,000,000,000,000,000 = 10^{18}
peta-	P	1,000,000,000,000,000 = 10^{15}
tera-	T	1,000,000,000,000 = 10^{12}
giga-	G	1,000,000,000 = 10^{9}
mega-	M	1,000,000 = 10^{6}
kilo-	k	1,000 = 10^{3}
deca-	D	10 = 10^{1}
deci-	d	0.1 = 10^{-1}
centi-	c	0.01 = 10^{-2}
milli-	m	0.001 = 10^{-3}
micro-	μ	0.000 001 = 10^{-6}
nano-	n	0.000 000 001 = 10^{-9}
pico-	p	0.000 000 000 001 = 10^{-12}

This page left blank intentionally

S.1 Introduction

The U.S. Department of Energy (DOE) prepared this *Final Environmental Impact Statement for Remediation of Area IV and the Northern Buffer Zone of the Santa Susana Field Laboratory (Final SSFL Area IV EIS)* in accordance with the National Environmental Policy Act (NEPA) and Council on Environmental Quality (CEQ) and DOE implementing regulations at Title 40, *Code of Federal Regulations*, Parts 1500-1508 (40 CFR Parts 1500-1508) and 10 CFR Part 1021, respectively. Past activities at the Santa Susana Field Laboratory (SSFL), Ventura County, California, resulted in chemical and radiological releases that impacted soil, buildings, and groundwater. Residual chemicals and radionuclides from historical operations in Area IV associated with soil, buildings, and groundwater, as well as soil contamination in the Northern Buffer Zone (NBZ) that is contiguous to and emanating from Area IV, need to be cleaned up. Extensive soil sampling and analysis in recent years has demonstrated that the chemical contamination is more widespread than the radiological contamination, and that contaminants are concentrated near certain facilities, rather than being evenly distributed across the site.

This environmental impact statement (EIS) analyzes the potential environmental impacts of alternatives for conducting cleanup activities in Area IV (290 acres) and the NBZ (182 acres). There are separate alternatives for soil remediation, building demolition, and groundwater remediation.

For soil remediation, this EIS analyzes an alternative that would entail cleanup to meet the Look-Up Table (LUT) values for residual concentrations of chemicals and radionuclides in soil established in accordance with the 2010 *Administrative Order on Consent for Remedial Action* (2010 AOC) between DOE and the California Department of Toxic Substances Control (DTSC) (DTSC 2010a) (the Cleanup to AOC LUT Values Alternative). In preparing this EIS, DOE identified challenges to implementing this alternative, including difficulty determining when the AOC LUT values have been met and difficulty finding suitable replacement soil that meets the AOC LUT values. Consistent with NEPA requirements, this EIS also analyzes a no action alternative (no soil treatment or removal), as well as two additional action alternatives (a Cleanup to Revised LUT Values Alternative and a Conservation of Natural Resources Alternative that includes both a Residential Scenario and an Open Space Scenario [in which the assumed receptor is a recreational user]). The additional action alternatives would meet the cleanup objectives to be protective of the environment and the health and safety of the public and workers while avoiding some of the technical challenges and potential adverse environmental impacts associated with cleanup to the 2010 AOC LUT values.

For buildings, DOE's action alternative is to demolish the 18 structures it owns in Area IV and transport the materials off site for disposition (Building Removal Alternative); the EIS also analyzes a no action alternative of leaving the structures in place. To address groundwater contamination, this EIS analyzes current levels of monitoring (no action), additional monitoring to better support natural attenuation (Groundwater Monitored Natural Attenuation Alternative), and active treatment of contaminated groundwater (Groundwater Treatment Alternative).

This EIS will inform Federal decisions about remediation of contaminated soil and groundwater, building demolition, restoration of the impacted environment, and disposal of chemical and radioactive materials. DOE's conclusions resulting from the evaluation of alternatives in this EIS are presented in Section S.12 of this Summary.

This EIS also responds to an order by the U.S. District Court for the Northern District of California, which permanently enjoins DOE from transferring possession or otherwise relinquishing control over any portion of Area IV until DOE has completed an EIS and issued a Record of Decision (ROD). The order is the result of a lawsuit filed by the Natural Resources Defense Council, the Committee to Bridge the Gap, and the City of Los Angeles, which challenged DOE's 2003 *Final Environmental*

Assessment for Cleanup and Closure of the Energy Technology Engineering Center (*ETEC EA*) (DOE 2003) and Finding of No Significant Impact (FONSI) for remediation of Area IV.[1]

DOE issued an Advance Notice of Intent to prepare an EIS and conduct public involvement activities in the October 17, 2007, *Federal Register* (FR) (72 FR 58834). A Notice of Intent (NOI) to prepare this EIS was published in May 2008 (*Notice of Intent to Prepare an Environmental Impact Statement for Remediation of Area IV of the Santa Susana Field Laboratory and Conduct Public Scoping Meetings* [73 FR 28437]).

Due to the availability of more-recent site characterization data and issuance of the 2010 AOC, DOE held a second scoping period in 2014 that was initiated by the *Amended Notice of Intent to Prepare an Environmental Impact Statement for Remediation of Area IV of the Santa Susana Field Laboratory and Conduct Public Scoping Meetings*, (79 FR 7439) published February 7, 2014.

On January 13, 2017, the U.S. Environmental Protection Agency (EPA) published a notice in the *Federal Register*, announcing the availability of the *Draft SSFL Area IV EIS* (82 FR 4336). A 60-day comment period from January 13 to March 14, 2017 was announced to provide time for interested parties to review and comment on the *Draft SSFL Area IV EIS*. On March 17, 2017, EPA published an amended *Federal Register* notice, announcing an extension of the public comment period to April 13, 2017. In preparing this *Final SSFL Area IV EIS*, DOE made revisions to the *Draft SSFL Area IV EIS* in response to comments received from other Federal agencies, State and local government entities, Native American tribes, and the public. In addition, DOE updated information due to events or the availability of information in other documents published since the *Draft SSFL Area IV EIS* was issued. Change bars in the margins of the pages in this Summary and Volumes 1 and 2 of this *Final SSFL Area IV EIS* indicate where substantive changes were made and where text was added or deleted.

S.2 Purpose and Need for Agency Action

DOE needs to complete remediation of Area IV and the NBZ[2] to comply with applicable requirements for cleanup of radiological and hazardous substances. These requirements include laws, regulations, orders, and agreements. To this end, DOE proposes to remove the remaining DOE structures in Area IV of SSFL and clean up the affected environment in Area IV and the NBZ in a manner that is protective of the environment and the health and safety of the public and workers.

S.3 Proposed Action

DOE proposes to remove existing DOE-owned facilities and support buildings from Area IV; remediate chemically and radiologically impacted soil in Area IV and the NBZ; remediate groundwater in Area IV and the NBZ; dispose of resulting material; and restore the affected environment in accordance with applicable laws, orders, regulations, and agreements with the State of California.

S.4 History of the Site

Located in Ventura County, California, on approximately 2,850 acres in the hills between Chatsworth and Simi Valley, SSFL was developed as a remote site to test rocket engines and conduct nuclear research (**Figure S–1**). Rockwell International's Rocketdyne Division (based in Canoga Park,

[1] *Order Granting Plaintiffs' Motion for Summary Judgment* (Case No. 3:04-CV-04448-SC, May 2, 2007).

[2] In this EIS, statements regarding DOE soil remediation in the NBZ refer to those portions of the NBZ that have been impacted by past DOE operations. Portions of the NBZ also are being addressed by the National Aeronautics and Space Administration (NASA), where releases from past NASA operations performed in Area II have migrated into the NBZ.

California) began rocket engine testing in the Area I portion of SSFL in 1947. Rockwell created Atomics International in the early 1950s to conduct nuclear research in Area IV for the Atomic Energy Commission (AEC) (a predecessor agency of DOE) and commercial entities. In 1996, Rockwell International sold its aerospace and defense business, including Area IV of SSFL, to The Boeing Company (Boeing).

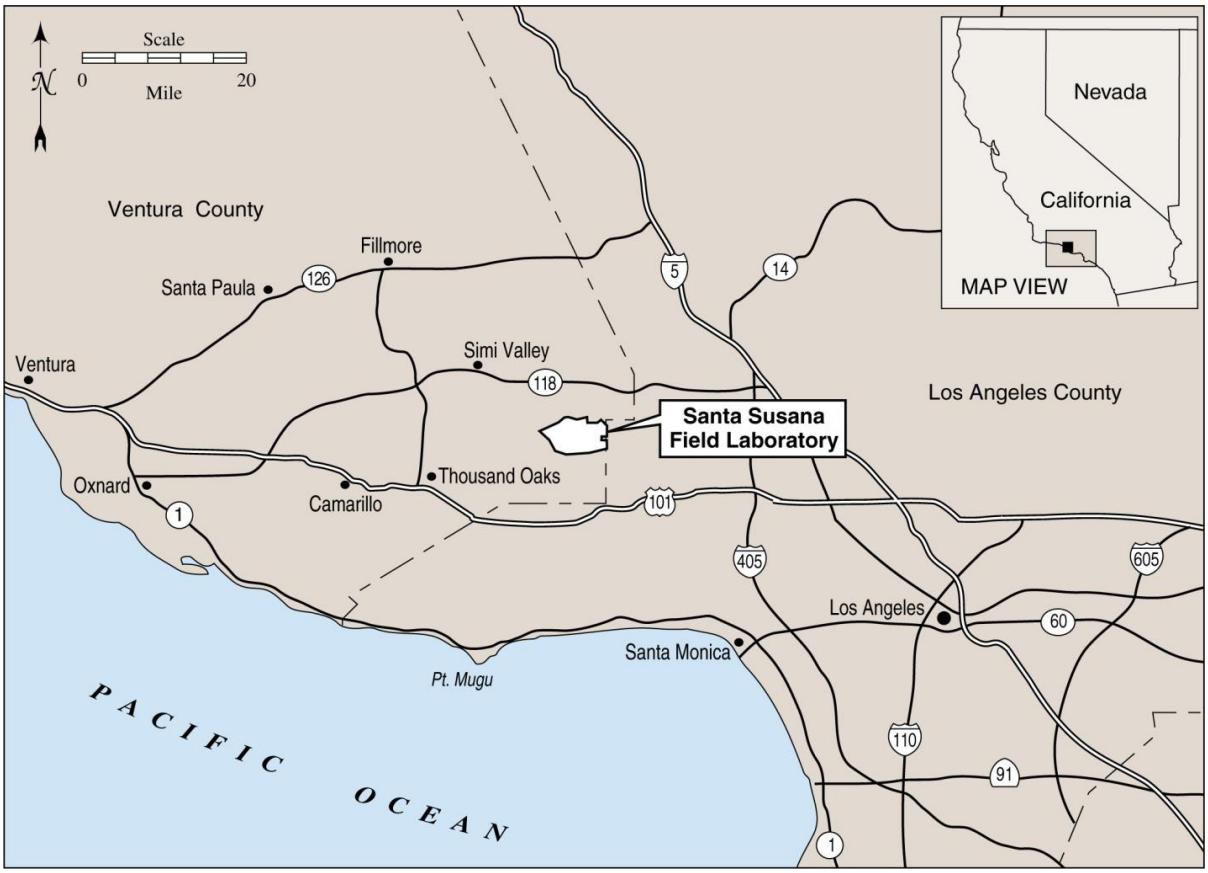

Figure S–1 Project Location, Santa Susana Field Laboratory

SSFL is divided into four administrative areas and two contiguous buffer zones north and south of the administrative areas. **Figure S–2** shows SSFL and the surrounding communities, including the layout of SSFL (Areas I, II, III, and IV and the adjacent buffer zones) and land ownership. The majority of Area I is owned and operated by Boeing. Area II and a 42-acre parcel within Area I are owned by the Federal Government and administered by the National Aeronautics and Space Administration (NASA). Areas III, IV, and the contiguous buffer zone areas to the north and south are owned by Boeing. DOE does not own any land at SSFL, but is the owner of 18 buildings in Area IV and is responsible for building demolition and cleanup of soils and groundwater in Area IV and the NBZ.

Starting in the mid-1950s, AEC funded nuclear energy research on a 90-acre parcel of land in what is now SSFL Area IV that was owned by Rocketdyne. The Energy Technology Engineering Center (ETEC) was established by AEC on this parcel in the early 1960s as a "center of excellence" for liquid metals research (primarily sodium, potassium, and mercury) and general metals compatibility testing. In support of that mission, DOE built and operated 10 small nuclear reactors for various research activities over the years. As a result of operating these research reactors and conducting nuclear research, chemicals and radionuclides were released into the soil, bedrock, and groundwater.

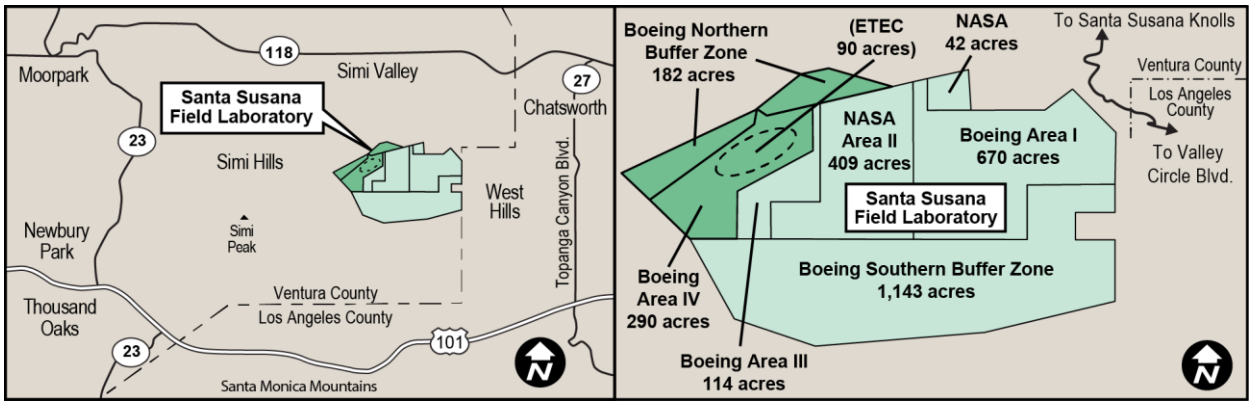

Figure S–2 Santa Susana Field Laboratory and Surrounding Communities

As part of the operations of a research and development site, structures were constantly used, cleaned, and refurbished for a new purpose or demolished. Cleanup activities have been ongoing since the 1960s. DOE decontaminated and demolished many of its structures and facilities in Area IV to the standards in effect at the time decommissioning occurred (see, for example, the discussion of prior cleanup in Section S.10.2.2, under 2010 AOC Soil Cleanup Standards), in accordance with its authority under the Atomic Energy Act of 1954, as amended. The major periods of building demolition were 1975 through 1977 and 1995 through 2005. By 1980, all reactor operations had ceased, and nuclear research at ETEC was terminated in 1988. DOE has removed all nuclear materials from the site. By the time non-nuclear liquid metals research ended in 1998, many facilities had been decontaminated, decommissioned, and demolished, and contaminated materials had been removed. As appropriate, these activities were covered by categorical exclusions, in accordance with DOE's "NEPA Implementing Regulations" (10 CFR Part 1021, Appendix B to Subpart D).

In the early 2000s, DOE decided to prepare an environmental assessment (EA) for the remaining cleanup activities. An EA is used to assess whether a proposed Federal action would have significant impacts on the environment. DOE issued the *ETEC EA* (DOE 2003) in March 2003. The *ETEC EA* evaluated the potential impacts of implementing additional cleanup and closure activities, including decontaminating and decommissioning the remaining sodium facility and other support facilities. DOE issued a FONSI for the EA on March 31, 2003, and began cleanup activities by undertaking limited building demolition.

In October 2004, the Natural Resources Defense Council, the Committee to Bridge the Gap, and the City of Los Angeles challenged the *ETEC EA* and FONSI in a Federal district court, claiming DOE had violated NEPA; the Comprehensive Environmental Response, Compensation, and Liability Act; and the Endangered Species Act (ESA). In May 2007, the court issued an order[3] that permanently enjoins DOE from transferring possession or otherwise relinquishing control over any portion of Area IV until DOE has completed an EIS and issued a ROD pursuant to NEPA. DOE suspended physical demolition and removal activities for its remaining facilities at ETEC, except for those activities necessary to maintain the site in a safe and stable configuration, until completion of this Final EIS and one or more RODs.

In 2007, DTSC issued the *Consent Order for Corrective Action* (2007 CO) (DTSC 2007) to DOE, NASA, and Boeing (as respondents), pursuant to DTSC's authority over hazardous waste under the California Health and Safety Code, Section 25187. The 2007 CO requires the respondents to clean up all

[3] *Order Granting Plaintiffs' Motion for Summary Judgment* (Case No. 3:04-CV-04448-SC, May 2, 2007).

chemically contaminated soils[4] and groundwater at SSFL to risk-assessment-based levels.[5] The risk-assessment-based levels are based on a suburban resident scenario established for SSFL in the *Final Standardized Risk Assessment Methodology Revision 2 Addendum, Santa Susana Field Laboratory, Ventura County, California* (SRAM) (MWH 2014),[6] which assumed a receptor would be present on the site 24 hours per day, 350 days per year, for 30 years. The 2007 CO required further characterization of the nature and extent of contamination at SSFL and identified the Resource Conservation and Recovery Act (RCRA) studies and work plans that would be prepared.

The 2007 CO requires:

- cleanup of chemically contaminated soils by June 30, 2017, using the 2005 SRAM Work Plan (Rev. 2);
- implementation of DTSC-approved groundwater and unsaturated zone cleanup remedies in the Chatsworth Formation Operable Unit by June 30, 2017, or earlier; and
- completion of construction of the DTSC-approved long-term soil cleanup remedy in the surficial media operable unit by June 30, 2017, or earlier.

The SRAM (MWH 2014) describes a risk-assessment methodology for determining the areas that would need remediation. A hypothetical future suburban residential land use was identified for the evaluation of risk; other plausible receptors (such as recreational users or workers) were also identified.

In 2010, DOE entered into the 2010 AOC (DTSC 2010a) with DTSC. The 2010 AOC superseded the 2007 CO with respect to soil remediation and changed the framework for the soils characterization and cleanup process for Area IV and the NBZ.[7] The 2010 AOC stipulated that the soils cleanup standard would be based on LUT values, which are: (1) for chemicals, local background concentrations or method detection limits[8] for those chemicals whose method detection limits exceed local background concentrations, and (2) for radionuclides, local background concentrations or minimum detection limits for radionuclides whose detection limits exceed local background concentrations. The 2010 AOC defines the minimum detection limit for a radionuclide as the smallest amount of activity that can be quantified for comparison with regulatory limits.[9] The 2010 AOC indicates that, for soil remediation decisions, DOE is to compare the concentration of any chemical or radionuclide in each individual sample (not an average of samples in an area) with its respective

[4] The 2010 AOC (DTSC 2010a) superseded the 2007 CO (DTSC 2007) with respect to cleanup of chemically and radioactively impacted soils; however, it incorporated the 2007 CO by reference for groundwater remediation. The 2010 AOC also added building demolition.

[5] The risk-based cleanup targets for soil under the 2007 CO are a risk of 1×10^{-6} (a lifetime chance of 1 in 1 million of developing a cancer), and a hazard index of 1 (the level below which no toxic effects would be expected). Safe Drinking Water Act maximum contaminant levels are the target cleanup levels for groundwater

[6] The 2007 CO cited a 2005 version of the SRAM Work Plan. The currently applicable version of the SRAM (MWH 2014) was issued in 2014.

[7] The 2007 CO remains in effect for groundwater remediation.

[8] Per the 2010 AOC, "detection limit" means the method reporting limit, which is the lowest concentration at which an analyte can be confidently detected in a sample and its concentration can be reported with a reasonable degree of accuracy and precision.

[9] In its *Final Technical Memorandum, Look-Up Table Recommendations, Santa Susana Field Laboratory Area IV Radiological Study* (HGL 2012b), EPA stated: "In exercising independent technical judgment, as identified in Section 5.2 of the 2010 AOC (DTSC 2010a), EPA recommends an adjustment to the BTVs [background threshold values] and minimum detectable concentrations [limits] (MDCs) to include appropriate consideration for [method uncertainty] to ensure an acceptably low decision error rate of approximately 5 percent. This adjustment is not believed by EPA to be contrary to the 2010 AOC requirement that LUT values incorporate BTVs and laboratory MDCs." The memorandum also stated: "For purposes of this technical memorandum, and for the appropriate use of BTVs, it is important to note that the MDC is not used as a detection decision criterion. Rather, the MDC is understood to represent a level of activity at which the associated uncertainty becomes predictably constrained to a level that is useful for defining a substitute cleanup value when the BTV is not practically or technologically supported by the laboratory data. The use of the MDCs in this case, defined as "the smallest amount of activity that can be quantified for comparison with regulatory limits," is consistent with the 2010 AOC requirements and definitions."

LUT value. Thus, any soil samples that do not meet the LUT values for all chemicals or radionuclides would require a cleanup action to be taken.

The 2010 AOC (DTSC 2010a) identified characterization activities for both chemical and radiological contaminants and requires DOE to prepare a soil remediation plan (referred to as a Soils Remedial Action Implementation Plan [SRAIP] in the 2010 AOC)[10] describing where soil cleanup will occur, any areas proposed for exemptions to protect biological or cultural resources, and any areas proposed for *in situ* or onsite treatment to achieve cleanup goals. The 2010 AOC specifies that no "leave-in-place" alternative (onsite burial or landfill) is allowed. Chemicals and radionuclides in soil brought in as backfill also must meet the LUT values. Verification of cleanup levels and the acceptability of the backfill are required by DTSC for chemicals. The 2010 AOC anticipated EPA support for verification of cleanup levels for radionuclides and assistance in verifying that backfill/replacement soils are consistent with LUT values for radionuclides. EPA is not a signatory to the 2010 AOC. Any future involvement by EPA (e.g., verification sampling) would be contingent on future agreements and funding, similar to those established for EPA's previous radiological characterization of Area IV and the NBZ. The 2010 AOC also specifies that the SRAIP shall include a schedule that ensures that the identified (soil cleanup) activities can be accomplished by 2017. In June 2017, DOE submitted a letter to DTSC documenting the mutually acknowledged situation that cleanup cannot proceed until required environmental documents (e.g., this EIS, the DTSC program environmental impact report) are completed and that DOE was therefore unable to meet the 2017 cleanup expectations as described in the 2010 AOC (DOE 2017).

Not all of the energy research conducted in Area IV was performed for DOE; some energy research was performed by Boeing and its predecessors for commercial entities. DOE has responsibility for cleanup of soils in the 290-acre Area IV. DOE shares responsibility with NASA for cleanup of soil in the 182-acre NBZ; NASA is responsible for cleanup of contamination in the NBZ that emanates from areas that it administers (DTSC 2010b). DOE shares responsibility with Boeing for groundwater remediation in Area IV and the NBZ, as defined in the 2007 CO (DTSC 2007). DOE has responsibility for demolition of the 18 DOE-owned buildings in Area IV. Boeing is responsible for management decisions regarding the Area IV buildings it owns.

S.5 Future of Area IV and the Northern Buffer Zone

Boeing is the landowner of Area IV and the NBZ. Prior to publication of the Draft EIS, Boeing stated that its intent was to maintain its portion of SSFL (including Area IV and the NBZ) as undeveloped open space. Further, Boeing stated that it would restrict future land use to prevent development for any commercial, industrial, agricultural, or residential purpose. Boeing also stated that it would restrict future land use to ensure the property would be protected as undeveloped open space, regardless of zoning changes beyond its control (Boeing 2016). Subsequent to issuance of the Draft EIS, Boeing formalized its intent to protect its property at SSFL as open space. In 2017, Boeing and North American Land Trust entered into two Grant Deeds of Conservation Easement and Agreements (conservation easements) to permanently preserve nearly 2,453 acres of land at SSFL, including Area IV and the NBZ, as open space (Ventura County 2017a, 2017b). The conservation easements are legally enforceable documents that, among other restrictions, forever prohibit residential, agricultural, or commercial development or uses of the site. They permanently bind the

[10] The 2010 AOC requires DOE to prepare a SRAIP that includes a site description and history and a description of the nature and extent of radiological and chemical contamination, planned remedial actions, proposed exemptions, proposed areas for onsite treatment, proposed mitigations to address environmental impacts, and schedule. DOE may prepare multiple soil remediation plans to address different implementation phases.

property, regardless of who owns the land. North American Land Trust will monitor and enforce the conservation easements.

S.6 Cooperating Agencies

CEQ NEPA regulations (40 CFR 1501.6) establish the requirements for cooperating agencies (see text box). For this EIS, there are three cooperating agencies: NASA, the U.S. Army Corps of Engineers, and the Santa Ynez Band of Chumash Indians (a federally recognized Native American tribe with historical ties to the SSFL land). EPA and DTSC were also invited to be a cooperating agency, but declined.

Cooperating Agencies (from 40 CFR 1508.5)

"Cooperating agency means any Federal agency other than a lead agency that has jurisdiction by law or special expertise with respect to any environmental impact involved in a proposal (or a reasonable alternative) for legislation or other major Federal action significantly affecting the quality of the human environment. The selection and responsibilities of a cooperating agency are described in 40 CFR 1501.6. A State or local agency of similar qualifications or, when the effects are on a reservation, an Indian Tribe, may by agreement with the lead agency become a cooperating agency."

S.7 Decisions to Be Supported

DOE is proposing to remove existing DOE-owned facilities and support buildings, remediate radiologically and chemically impacted soil and groundwater, dispose of the resulting material, and restore the affected environment. The 2007 CO (DTSC 2007), which is applicable to groundwater, requires a risk-based cleanup approach based upon the methodology in the SRAM (MWH 2014) that was approved by DTSC. The 2010 AOC (DTSC 2010a) requires soil cleanup to LUT values. These two DTSC Orders specify how the cleanup standards are to be developed for SSFL Area IV soil and groundwater remediation.

This EIS evaluates reasonable alternatives for how DOE can conduct the cleanup of Area IV and the NBZ. DOE has developed separate reasonable alternatives for the three components that make up its remediation project: soil remediation, building demolition, and groundwater remediation. As required by CEQ NEPA regulations (40 CFR 1508.25), DOE is also evaluating no action alternatives for soil remediation, building demolition, and groundwater remediation. For each component of its remediation project, DOE may select one of the alternatives described in this EIS, or DOE may combine different aspects of the alternatives and create a "hybrid" alternative.

The potential environmental impacts presented in this EIS, along with public input, cost, policy, and other factors, will be considered by DOE decision-makers in selecting alternatives for soil remediation, building demolition, and groundwater remediation for implementation. DOE's decision resulting from the analysis in this EIS will be announced in one or more RODs that will be issued no sooner than 30 days after the EPA Notice of Availability for this Final EIS was published in the *Federal Register*.

If DOE decides to implement the building removal alternative, DOE would pursue plans to implement the selected alternative for the 13 DOE buildings that are not regulated by DTSC as hazardous waste facilities. Implementation of a building demolition decision for any of the five DTSC-regulated facilities, as well as decisions on soil and groundwater remediation, is contingent on completion and/or approval of a number of other documents. These documents are addressed in Chapter 1, Section 1.9, of this EIS.

S.8 Public Involvement

DOE considers public involvement to be a critical element in the cleanup and closure of SSFL and has incorporated extensive public involvement opportunities for the planning activities it is conducting related to cleanup of Area IV and the NBZ. DOE has complied with the spirit and intent of NEPA public involvement requirements by implementing public involvement efforts seeking to include all

SSFL stakeholders. SSFL stakeholders have expressed varying, and sometimes conflicting and competing, points of view.

S.8.1 Early Public Involvement

DOE's efforts to enhance its interactions with the community began in earnest in 2008 when it commissioned interviews of SSFL stakeholders representing the range of perspectives among community members. These interviews revealed, among other issues, concerns about the completeness of the historical information available about the site. These observations and concerns are documented in *Report on Community Interviews: Community Concerns and Preferences for Public Participation in Cleanup of Area IV Santa Susana Field Laboratory* (P2 Solutions 2009).

Using the community interviews as a foundation, DOE prepared the *Community Involvement Plan Area IV Santa Susana Field Laboratory* in 2010 (DOE 2010). The plan describes how DOE provides timely, accurate, and credible information and/or access to information to the public, agencies, and organizations that are interested in and may be affected by the SSFL remediation and closure process. It also describes DOE plans to continue to provide opportunities for public contributions to selected project issues, reports, plans, and other project documents that DOE will use in its decision-making process. In addition, the plan describes the overarching objectives of building and improving relationships with regulators, elected officials, and the affected public; fostering a coordinated approach to address cleanup; and evaluating DOE activities to modify and enhance public participation (DOE 2010).

A principal component of the NEPA process is active public participation (see **Figure S–3**). DOE has conducted a number of activities to encourage public input in the NEPA process. DOE's NEPA regulations require a public meeting for scoping and a public hearing for a draft EIS (10 CFR 1021.311 and 1021.313, respectively). The regulations also require a minimum 30-day scoping comment period and a minimum 45-day public comment period on a draft EIS. These NEPA public involvement opportunities are described below.

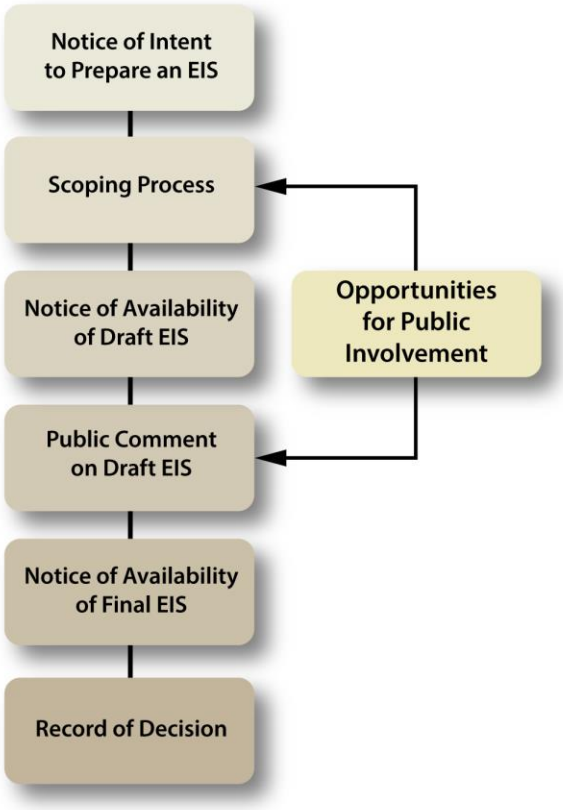

Figure S–3 EIS Public Involvement Opportunities

The purpose of scoping-related public involvement activities is to inform the public about an EIS early in the process and obtain public input on issues of concern and development of alternatives. DOE issued an Advance Notice of Intent to prepare an EIS in October 2007. Scoping was initially conducted in 2008; however, because of changed soil remediation requirements resulting from the 2010 AOC (DTSC 2010a) and the availability of more-recent site characterization data, DOE issued an Amended NOI (79 FR 7439) and conducted another public scoping period in 2014.

During the 2008 *Draft SSFL Area IV EIS* scoping period from May to August, DOE held six scoping meetings to present the proposed alternatives and receive comments from agencies, organizations, and the public. The scoping meetings were held in Simi Valley, Northridge, and Sacramento,

California. DOE received 750 individual comments from 74 commenters, including individuals; elected officials; special interest groups; and Federal, State, and local agencies during the 2008 scoping period. The comments are documented in the *Scoping Comment Responses for the Environmental Impact Statement for Remediation of Area IV of the Santa Susana Field Laboratory* (DOE 2009).

In spring 2012, DOE sponsored three Community Alternatives Development Workshops in which the community was asked to articulate their preferences for alternatives that they would like to see included in this EIS. DOE presented information on how alternatives are developed and what criteria they need to meet. Stakeholders then broke into groups and developed alternatives to be considered by DOE.

The 2014 scoping period announced in the February 2014 Amended NOI ended on April 2, 2014. DOE held scoping meetings in Simi Valley and Agoura Hills/Calabasas, California. Over the 55-day scoping period, DOE received a total of 1,272 comments from 309 commenters, including individuals, an elected official, organizations, Government agencies, a Native American organization, and a Native American tribe. Information on scoping and comments received is included in the 2014 *Environmental Impact Statement for Remediation of Area IV and the Northern Buffer Zone of the Santa Susana Field Laboratory Final Scoping Summary Report* (DOE 2014).

DOE reviewed the comments provided during the 2008 and 2014 scoping periods and the 2012 Community Alternatives Development Workshops. DOE developed alternatives for this EIS based, in part, on input from the stakeholders.

Summary documents of comments received during these scoping efforts, along with information on additional EIS-related public involvement activities, are available on the ETEC website at: http://etec.energy.gov/Char_Cleanup/EIS.html.

S.8.2 Draft EIS Public Involvement

On January 13, 2017, EPA published a notice in the *Federal Register*, announcing the availability of the *Draft SSFL Area IV EIS* (82 FR 4336). A 60-day comment period, from January 13 to March 14, 2017, was announced to provide time for interested parties to review and comment on the Draft EIS. On March 17, 2017, EPA published an amended *Federal Register* notice, announcing an extension of the public comment period to April 13, 2017 (82 FR 14217). During the public comment period, DOE held two public hearings and a hearing for Native Americans, to provide participants with opportunities to learn more about the content of the Draft EIS from exhibits, fact sheets, and other materials; to hear DOE representatives present the results of the Draft EIS analyses; to ask questions; and to provide oral or written comments.

DOE received comments from Federal agencies, State and local governmental entities, Native American tribal governments, and members of the public. DOE responses to the comments received in 1,363 submittals are included in the Comment Response Document (CRD) that is part of this Final EIS. After reviewing of the comments received on the *Draft SSFL Area IV EIS*, DOE identified several topics of interest to be addressed in CRD. These include topics of broad interest or concern as indicated by their recurrence in comments or technical topics that warrant a more detailed discussion than might be afforded in responding to an individual comment. These topics include:

- Preferences for cleanup
- Compliance with the 2010 AOC
- Suitable backfill soil
- Application of exemptions under the 2010 AOC

- Toxicity of soil contaminants
- Comparison of radiation doses
- Offsite impacts
- Cancer and other illnesses near SSFL
- Options for transportation of waste from SSFL
- Public perceptions about waste and contamination in Area IV

S.9 Organization of this Environmental Impact Statement

This EIS consists of this summary, 14 chapters, supporting appendices, and a CRD. The chapters, appendices, and CRD are as follows:

- Chapter 1, "Introduction," describes DOE's purpose and need for action, background history for SSFL Area IV, decisions to be supported, related NEPA documents, and public involvement through the NEPA process.
- Chapter 2, "Alternatives," describes the range of reasonable alternatives for remediation of Area IV and the NBZ, as well as the alternatives that were considered but eliminated from detailed study in this EIS. It also presents a summary of the potential environmental impacts by alternative.
- Chapter 3, "Affected Environment," describes the potentially affected environments at Area IV and the NBZ. These data are provided as the baseline against which the potential impacts of each of the alternatives can be compared.
- Chapter 4, "Environmental Consequences," describes the potential impacts of the alternatives. Environmental consequences were evaluated for each alternative for the same resources areas described in Chapter 3.
- Chapter 5, "Cumulative Impacts," describes the potential cumulative impacts of the action alternatives in combination with other past, present, and reasonably foreseeable future actions. The chapter presents information regarding the cumulative impacts of DOE, NASA and Boeing activities, as well as the cumulative impacts from other activities in the region.
- Chapter 6, "Measures to Minimize Impacts and Mitigation Measures," provides information on planned measures to minimize potential impacts, as well as potential methods of mitigating impacts under the action alternatives.
- Chapter 7, "Resource Commitments," addresses sustainability, potential unavoidable adverse impacts to the environment, irreversible and irretrievable commitments of resources, and short-term impacts versus long-term productivity of Area IV and the NBZ from implementing the action alternatives.
- Chapter 8, "Laws, Regulations, and Other Requirements," describes the environmental and health and safety compliance requirements governing implementation of the alternatives.
- Chapter 9, "Native American Histories and Perspectives," describes the significance of SSFL to the native peoples who inhabited the site before it began operations as a field laboratory.
- Chapters 10, 11, 12, 13, and 14 are the "References," "Glossary," "Index," "List of Preparers," and "Distribution List" chapters, respectively.

- Appendices are included to provide more-detailed information to support this EIS.
  - Appendix A, "*Federal Register* Notices"
  - Appendix B, "Environmental Consequences Methodologies"
  - Appendix C, "Alternatives Development"
  - Appendix D, "Detailed Project Information"
  - Appendix E, "Consultations"
  - Appendix F, "Cultural Resources"
  - Appendix G, "Evaluation of Remediation Activity Impacts on Human Health"
  - Appendix H, "Evaluation of Transportation and Traffic Impacts"
  - Appendix I, "Wetlands Assessment"
  - Appendix J, "U.S. Fish and Wildlife Service Biological Opinion"
  - Appendix K, "Cost-Benefit Analysis Report"
  - Appendix L, "Sensitivity Evaluations"
  - Appendix M, "Contractor Disclosure Statement(s)"
- A CRD volume that describes the public comment process; presents topics of interest that occurred frequently in public comments or resulted in a detailed response; and a side-by-side presentation of comments received and DOE's responses.

S.10 Alternatives

This section describes the reasonable alternatives for remediation of SSFL Area IV and the NBZ. DOE is evaluating separate alternatives for soil remediation, building demolition, and groundwater remediation. DOE proposes to complete remediation of Area IV and the NBZ to comply with applicable requirements for cleanup of chemical and radioactive constituents. Orders, regulations, and agreements affecting the development of this EIS include, but are not limited to, the *Order Granting Plaintiffs' Motion for Summary Judgment* from the lawsuit challenging DOE's 2003 *ETEC EA* (DOE 2003) and FONSI (see Section S.4); the CEQ and DOE NEPA regulations; the 2010 AOC (DTSC 2010a), and the 2007 CO (DTSC 2007). This section further discusses these requirements and explains how they, as well as changes in circumstances since issuance of the Draft EIS, informed the development of action alternatives analyzed in this EIS.

Whereas the development of alternatives for building demolition and groundwater remediation was straightforward, the alternatives for soil remediation evolved as DOE considered comments from the public and cooperating agencies (Santa Ynez Band of Chumash Indians 2014), evaluated the complexities of implementing soil cleanup in accordance with the 2010 AOC, and adjusted to reflect commitments to future land use. It is important for decision-makers, people living near SSFL, and other stakeholders to understand the process DOE employed in identifying the soil remediation alternatives evaluated in this EIS.

DOE considered a number of soil remediation alternatives, informed by public input. After entering into the 2010 AOC, DOE developed an action alternative for soil remediation that implemented the technical elements of that consent order—that is, cleanup to meet the LUT values for residual concentrations of chemicals and radionuclides in soil established in accordance with the 2010 AOC. DTSC published LUT values for 116 chemicals and provisional LUT values for 16 radionuclides in 2013 (see Appendix D, Section D.2). In accordance with the 2010 AOC, these LUT values are

generally meant to limit contaminants remaining in soil after cleanup to local background levels, considering technical limitations in the measurement of these constituents in soil.

As data on levels of chemical and radioactive constituents in soil at Area IV, the NBZ, and background locations[11] became available and the AOC LUT values were established, DOE recognized that there would be technical issues (see Evaluation of Implementation of 2010 AOC Cleanup Requirements in Section S.10.2.2) associated with implementing a cleanup that meets the 2010 AOC requirements. DOE also determined that implementing the 2010 AOC requirements and remediating soil to meet the AOC LUT values would have the potential for adverse environmental impacts due to the large area of land that would be disturbed and the large volume of soil that would be removed. The CEQ NEPA regulations state that an EIS "shall provide full and fair discussion of significant environmental impacts and shall inform [decision-makers] and the public of the reasonable alternatives which would avoid or minimize adverse impacts or enhance the quality of the human environment" (40 CFR 1502.1). Input from stakeholders strongly suggested that DOE should analyze a full range of alternatives. Also, the Santa Ynez Band of Chumash Indians, a cooperating agency on this EIS, also expressed their expectation that DOE would include "a robust analysis of alternatives" (Santa Ynez Band of Chumash Indians 2014). DOE determined that it was necessary to develop additional action alternatives for soil remediation that were protective of human health and the environment to be analyzed in this EIS.

Another event that affected the alternatives evaluated in this Final EIS was a change in circumstances that occurred after issuance of the *Draft SSFL Area IV EIS*. In 2017, Boeing and North American Land Trust recorded two Grant Deeds of Conservation Easement and Agreements with Ventura County (Ventura County 2017a, 2017b) that permanently preserve as open space nearly 2,453 acres of land that Boeing owns at SSFL, including Area IV and the NBZ. These conservation easements are legally enforceable documents that, among other restrictions, forever prohibit residential, agricultural, or commercial development or uses of the site. Evaluation of additional soil remediation alternatives allows decision-makers and the public to compare the potential impacts from implementing the alternatives with those from implementing a cleanup that meets the 2010 AOC requirements.

For purposes of comparison, the soil remediation action alternatives evaluated in this EIS address remediation of the soil in Area IV and the NBZ to AOC LUT values for chemicals and radionuclides, revised LUT values for chemicals (that is, LUT values that are based on individual chemical risk), or risk-assessment-based values for chemicals and radionuclides (that also demonstrates compliance with DOE's dose limit for radionuclides). The building demolition action alternative (i.e., the Building Removal Alternative) addresses removal of the remaining DOE-owned buildings in Area IV and disposal of the debris off site. The groundwater remediation action alternatives address implementation of management practices to clean up groundwater in accordance with the requirements of the 2007 CO (DTSC 2007).

Each of the three sets of alternatives allows independent evaluation and comparison of the potential impacts of implementing each component of DOE's cleanup action. In addition, DOE evaluated the potential combined impacts of implementing each of the three cleanup components: soil remediation, building demolition, and groundwater remediation.

Under all alternatives, steps would be taken to protect biological and cultural resources, including limiting the amount of soil disturbance in biologically or culturally sensitive areas as provided for in

[11] Background reference areas located 3 to 6 miles from SSFL were identified to be representative of SSFL onsite soil conditions. Soils and sediments in these areas were sampled and analyzed to establish chemical (URS 2012) and radiological background levels (HGL 2011).

the 2010 AOC and to comply with applicable Federal, State, and local laws and regulations. To the extent practicable, and as approved by DTSC, DOE would use onsite treatment and natural attenuation to reduce the volume of soil that would be transported and disposed of off site. Soil in which chemical constituents would not attenuate (degrade) naturally on site to levels meeting cleanup criteria would be transported off site to permitted disposal facilities based on the type of waste. Locations where soil is excavated would be backfilled, recontoured, and stabilized with new vegetation. To the extent practicable, DOE would implement green remediation technologies and revegetate with native species.

A no action alternative is included for each of the three sets of alternatives. Evaluation of a no action alternative is required in accordance with CEQ NEPA regulations (40 CFR 1502.14(d)) because it establishes the baseline against which the potential environmental impacts of the action alternatives can be compared.

S.10.1 Alternatives Development

This section presents the alternatives development process, as well as a discussion of regulatory drivers, community involvement, changed circumstances, and the alternative concepts that were considered, but dismissed from detailed analysis.

S.10.1.1 Applicable Laws, Regulations, Orders, and Agreements

Removal of existing DOE-owned facilities and support buildings from Area IV, remediation of chemically and radiologically impacted soil and groundwater in Area IV and the NBZ, disposal of resulting waste, and restoration of the affected environment would be conducted in accordance with applicable laws, regulations, orders, and agreements with the State of California. The 2007 CO (DTSC 2007), which applies to groundwater in Area IV and the NBZ, calls for a risk-based cleanup approach for groundwater based on the methodology in the SRAM (MWH 2014)[12] that was approved by DTSC. The 2010 AOC (DTSC 2010a) requires soil cleanup to the AOC LUT values, which are based on soil background levels or method/minimum detection limits. The AOC also allows DOE and DTSC to agree upon changes to better meet cleanup objectives. DOE expects that it will need to engage DTSC in discussions about such changes in order to implement any soil remediation alternative. In addition, DOE would conduct its remediation activities in compliance with other applicable laws, regulations, and orders. These include other environmental regulations such as those implementing the Federal ESA, the Federal National Historic Preservation Act, and State and local requirements for protection of biological resources; safety regulations such as those addressing worker and public safety, and applicable Federal and California Executive Orders and DOE Orders.

S.10.1.2 Process and Criteria

Community input has been a major driver in the development of the alternatives for analysis in this EIS, and DOE has provided many opportunities over a number of years for the public to provide input. As discussed in Section S.1, preparation of this EIS began with an Advance NOI (72 FR 58834) in October 2007. Informal discussions with the public and other stakeholders were held, and the resulting information was used in developing the May 16, 2008, NOI (73 FR 28437). The 2008 NOI presented DOE's proposed alternatives and, in accordance with NEPA regulations, the public was invited to comment on the proposed alternatives or suggest other alternatives or alternative concepts.

Preparation of this EIS was delayed to allow EPA to conduct radiological characterization of Area IV and the NBZ; DOE to conduct chemical characterization; and DTSC to develop LUT values

[12] The 2007 CO (DTSC 2007) originally also applied to soil remediation in Area IV and the NBZ; the 2010 AOC (DTSC 2010a) superseded the 2007 CO for soil remediation. The 2014 SRAM (MWH 2014) supersedes the 2005 SRAM that was cited in the 2007 CO.

identifying the cleanup levels for chemicals and radionuclides. EPA's radiological characterization effort entailed a historical site assessment of past operations and radiological releases to identify locations for soil sampling (HGL 2012c); a gamma radiation scan, also to identify areas for soil sampling (HGL 2012e); collection and radiological analysis of 3,487 soil and 55 sediment samples (HGL 2012a); and radiological characterization of groundwater and surface water (HGL 2012d).[13] DOE's chemical characterization effort included a series of related, complimentary activities. DOE collected samples along with EPA at the locations EPA identified through its historical site assessment and gamma survey. DOE also sampled drainages and conducted random sampling of the NBZ in coordination with EPA. Finally, working with DTSC, DOE conducted a separate data gap analysis that reviewed site operations and chemical releases and identified additional locations that were sampled. The result of DOE's chemical characterization effort was the collection and analysis of 5,854 samples (CDM Smith 2017). DTSC published the provisional AOC LUT values for radionuclides in January 2013 (DTSC 2013a) and the AOC LUT values for chemicals in June 2013 (DTSC 2013b).[14] These AOC LUT values are presented in Appendix D, Tables D–2 and D–3.

In spring 2012, DOE sponsored a series of three Community Alternatives Development Workshops in which community members were asked to articulate their preferences for alternatives they would like to see analyzed in this EIS. The workshops resulted in four cleanup concepts that reflect the diverse preferences in the community. Appendix C provides details about the workshop process and the alternative cleanup concepts proposed by the community.

Despite the differences in their approaches to cleanup, the four community-developed concepts were similar in their focus on cleaning up and restoring Area IV and the NBZ to a level that allows use of the site as open space for wildlife or human enjoyment, as well as use of "green" and sustainable methods whenever possible to minimize the impact of cleanup on the site and the surrounding communities. All four of the alternative concepts recommended that DOE should take actions to minimize damage to the natural environment during cleanup. DOE designed all of the action alternatives to incorporate green cleanup methodologies. A summary of green cleanup principles adopted by DOE to guide the development of alternatives is included in the following Green Cleanup text box.

In addition, community concepts called for minimizing transportation impacts, preferential use of native plants for restoration of the site, and implementation of measures to prevent the spread of invasive, non-native plants. DOE considered all of these community concepts in preparing this EIS; these concepts informed the development of alternatives for this EIS.

Many community members who have expressed concerns about transportation, biological, and cultural resources impacts requested that DOE evaluate a risk-based cleanup alternative that might minimize these impacts. In response, in addition to evaluating an alternative for soil cleanup that meets the AOC LUT values, DOE evaluated alternatives that use a risk-based methodology to determine areas and soil volumes that require remediation, based on cleanup to risk levels, similar to concepts considered in the 2008 NOI (73 FR 28437).

In its 2014 Amended NOI, DOE summarized the history of the SSFL Area IV cleanup project, changes in regulatory requirements, and NEPA efforts to that date; presented the 2012 Community Alternatives Development Workshops concepts; announced scoping meetings and its intention to

[13] HydroGeoLogic, Inc., was the EPA contractor for the radiological characterization of Area IV and the NBZ.

[14] The radionuclide LUT values are provisional. EPA recommended not selecting final LUT values until a single laboratory is selected to conduct the radionuclide analysis for cleanup confirmation sampling and the selected laboratory can demonstrate its ability to meet EPA's defined measurement quality objectives. The chemical AOC LUT values are not provisional because they provide analytical standards for multiple laboratories to report and use when establishing data quality objectives (see Appendix D, Section D.2).

Green Cleanup

DOE is committed to integrating sustainability in its projects consistent with the requirements of Executive Order 13693, *Planning for Federal Sustainability in the Next Decade*. Impacts on the natural environment would be expected to result from the cleanup of Area IV and the NBZ, regardless of which action alternative is selected. DOE is committed to minimizing impacts by using the principles of "green cleanup." This approach is consistent with the DOE Office of Environmental Management's recognition of sustainability as an organizational goal at the highest levels of management (DOE 2015). To the extent practical, green and sustainable remediation and innovative technology practices will be integrated into all phases of remediation. Chapter 7 of this EIS provides additional detail on implementation of greener cleanup principles.

For this project, cleanup decisions for all action alternatives would be guided to the extent possible by the EPA *Principles for Greener Cleanups* (EPA 2009), the ASTM International *Standard Guide for Greener Cleanups* (ASTM 2013), and DTSC's *Interim Advisory for Green Remediation* (DTSC 2009). The purpose of EPA's principles, ASTM's standard guide, and DTSC's Advisory is to improve the decision-making process involved with site cleanup, while assuring the protection of human health and the environment by minimizing the environmental "footprint" of cleanup activities. Principal elements of green sustainable remediation are:

- **Minimize total energy and maximize use of renewable energy**
- **Minimize air pollutants and greenhouse gas emissions**
- **Minimize water use and impacts to water resources**
- **Reduce, reuse, and recycle materials and waste**
- **Protect land and ecosystems**

prepare this EIS; and provided the public with further opportunities to provide comments on the scope of this EIS and the alternatives to be evaluated.

After receiving stakeholder input from the 2014 scoping comments and the 2012 Community Alternatives Development Workshops, DOE developed screening and balancing criteria to identify alternatives to be evaluated in this EIS. The screening criteria were developed to ensure the proposed alternatives would meet the purpose and need for agency action as described in Section S.2. The balancing criterion included principles for cleanup in a manner that is as environmentally sensitive as possible. Descriptions of the criteria, including their development and selection process, are provided in Appendix C.

The main screening criteria selected were:

- Regulatory Compliance,
- Protect Public and Worker Health and Safety,
- Effectiveness, and
- Ease of Implementation.

The balancing criteria included:

- Protect the Environment,
- Protect Native American Interests,
- Cost,
- Community Acceptance,
- Return to Natural State,
- Minimize Transportation Impacts, and
- Preference for Onsite Treatment of Soils.

The actions discussed above led to the development of the alternatives that DOE presented in the Draft EIS. At the time the Draft EIS was issued, Boeing had indicated its intent to maintain its property at SSFL, which includes Area IV and the NBZ, as open space. That stated intent has now been formalized by two conservation easements and agreements that define acceptable uses and restrict development of Boeing's SSFL property (Ventura County 2017a, 2017b). For this Final EIS, DOE retained the alternatives included in the Draft EIS, but in response to comments on the Draft EIS and the establishment of conservation easements, in addition to evaluating a risk-based cleanup scenario based on a hypothetical future resident (Conservation of Natural Resources, Residential Scenario), DOE included a risk-based scenario that is consistent with the 2017 conservation easements that ensure that Area IV and the NBZ will exist only as open space following cleanup (Conservation of Natural Resources, Open Space Scenario).

S.10.1.3 Alternative Concepts Considered but Dismissed from Detailed Study

A number of alternative concepts were proposed by the public during the EIS scoping period in 2008, the Community Alternatives Development Workshops in 2012, and the EIS scoping period in 2014. Not all of these concepts are evaluated in detail as alternatives in this EIS. However, DOE incorporated most of these concepts into the alternatives described in this summary. **Table S–1** briefly describes the alternative concepts that were considered but dismissed from detailed analysis and the reasons why these concepts were not carried forward as alternatives evaluated in this EIS. More-detailed descriptions of these concepts, as well as a discussion of the analysis undertaken to evaluate each concept and inform DOE's dismissal of the concept from detailed study, are provided in Chapter 2, Section 2.2.3.

Table S–1 Matrix of Alternative Concepts Considered but Dismissed from Detailed Study

Alternative Concept	*Alternative Description*	*Reason(s) for Dismissal*
Cleanup by 2017, consistent with the 2010 AOC or any other action alternative	The 2010 AOC called for a schedule to be included in the Soil Remedial Action Implementation Plan that ensured soil cleanup was completed by 2017.	Prior to commencing cleanup, several regulatory actions must be completed: DOE must complete NEPA activities, including issuing a ROD; DTSC must complete CEQA activities and issue its Findings; DOE must prepare and DTSC must approve a soil remedial action implementation plan. This alternative concept was dismissed because these regulatory actions were not completed as of the deadline.
Transportation-Related Alternative Concepts	Proposed concepts ranged from minimizing the amount of transported soil to evaluating alternative transportation routes and methods.	Some of these concepts (e.g., minimizing the amount of transported soil) were incorporated into the alternatives evaluated in this EIS. DTSC included a transportation study in its *Draft Program EIR* that evaluated alternative means of transporting debris and soil from SSFL. DOE evaluated the study and agreed with DTSC's analysis and conclusion that the Woolsey Canyon Road truck route is the most feasible and has the fewest adverse environmental effects. A summary of the DTSC study is presented in Chapter 2, Section 2.2.4.
Ultimate Land Use of Area IV after Cleanup	Potential future land uses include museums and parks, a land grant to Native Americans, open space, a wildlife corridor, and a wildlife preserve.	DOE does not own the land in Area IV or the NBZ and cannot make decisions about its ultimate use. DOE's cleanup would be consistent with Boeing's intended future land use of undeveloped open space as provided for in its conservation easements (Ventura County 2017a, 2017b).

Alternative Concept	Alternative Description	Reason(s) for Dismissal
Other Soil Cleanup Concepts	Installation and use of catch basins downstream of relatively inaccessible areas of the northern drainages that contain chemicals or radionuclides exceeding AOC LUT values to capture water flushed down drainages (clean water would be introduced upstream to flush contaminants to the catch basins, where the then-contaminated water would be collected and treated for offsite disposal); helicopters/mules for difficult-to-access locations; dilution through soil mixing; and soil compaction into trucks.	These concepts raised regulatory or safety concerns: - Flushing contaminants from drainages does not meet DOE's purpose and need (e.g., is not protective of human health and the environment) - The safety risks associated with the use of helicopters or mules in steep terrain are greater than the expected benefits. - Dilution through soil mixing is not allowed for hazardous waste under RCRA regulations (40 CFR 268.3). For nonhazardous soils, this approach may not be effective in meeting cleanup goals because the concentrations of chemical and radioactive constituents in background soil are not significantly different from those in Area IV and NBZ soils. - Compacting soil in trucks would increase the need for water, present industrial hazards, and add to the timeline to complete the proposed action (e.g., time for loading and unloading each truck).
Cleanup Based on Different Land Use Scenarios	Cleanup based on a range of land uses.	The landowner's (Boeing's) intended future land use for their portion of SSFL, including Area IV and the NBZ, is undeveloped open space as established in conservation easements (Ventura County 2017a, 2017b). DOE assumed cleanup levels based on a hypothetical suburban residential land use scenario and an open space scenario.[a]
No Action (Abandon Area IV)	Proposed in the 2008 NOI. Cessation of all DOE management and oversight of SSFL Area IV.	DOE determined that for each of its activities (soil remediation, building removal, and groundwater remediation), a no action alternative of continued maintenance is adequate to provide a baseline for evaluating the action alternatives.
Onsite Containment at SSFL Area IV	Proposed in the 2008 NOI. Onsite containment (which would include burial) of buildings, wastes, and radiological and chemical contaminants, aligned with potential future land use scenarios including, but not limited to, agricultural, residential, and open space.	This concept was eliminated because the 2010 AOC does not allow onsite burial or landfilling (excavating and burying) of contaminated debris or soil, and it would entail a decision affecting future land use for land that DOE does not own. DOE's non-AOC alternatives (see Section S.10.2.3) include leaving in place constituents determined to meet risk-based standards, but do not include excavating soil and burying it elsewhere in Area IV.
Offsite Disposal of SSFL Area IV Materials (cleanup based on agricultural or open space risk assessment scenarios)	Proposed in the 2008 NOI. This alternative consisted of demolition of buildings and removal of contaminated media, aligned with potential future land use scenarios including, but not limited to, agricultural, residential, and open space. Nonradiological wastes would be transported to approved disposal or treatment facilities and radiological wastes to approved out-of-state disposal facilities.	This concept was partially considered in the development of the alternatives discussed in Sections 2.4.1 and 2.4.2 for soil remediation, in that the Cleanup to Revised LUT Values Alternative addresses soil cleanup based on chemical risk and soil cleanup under the Conservation of Natural Resources Alternative is based on a risk assessment for both chemicals and radionuclides. For this alternative, DOE evaluated a hypothetical suburban residential scenario and an open space scenario as potential future land uses. Other future land uses were not evaluated because they are prohibited by the Boeing conservation easements.[a]
Combination Onsite/Offsite Disposal Alternative for SSFL Area IV	Proposed in the 2008 NOI. Demolition of buildings and onsite containment (which would include burial) of contaminated media, aligned with potential future land use scenarios including, but not limited to, agricultural, residential, and open space. Nonradiological wastes would be transported to approved disposal or treatment facilities and radiological wastes to an approved out-of-state disposal facility.	The onsite disposal portion of this concept was eliminated because the 2010 AOC does not allow onsite burial or landfilling (excavating and burying) of contaminated debris or soil, and it would entail a decision affecting future land use for land that DOE does not own. DOE's non-AOC alternatives (see Section S.10.2.3) include leaving in place constituents determined to meet risk-based standards, but do not include excavating soil and burying it elsewhere in Area IV.

Alternative Concept	Alternative Description	Reason(s) for Dismissal
Alternate Use of Area IV Buildings	Possible use of the ETEC Office Building (Building 4038) as an interpretive center and the former Sodium Pump Test Facility (Buildings 4462 and 4463) for commercial purposes.	Neither of these concepts is sufficiently developed to be considered in this EIS. Commercial development or uses of Boeing-owned land (which includes Area IV and the NBZ) is prohibited in the conservation easements.[a]
Particle Size Separation/Soil Washing	Particle size separation: Use size separation to separate the contaminated size fractions from the non- or less-contaminated size fractions (typically sand and larger soil particles). Soil washing: Place contaminated soil into treatment units (similar to washing machines) in which mechanical agitation and a washing solution are used to remove contaminants from the soil.	Soil treatability studies conducted on Area IV soil demonstrated that particle size separation was not effective in producing soil fractions that met the AOC LUT values and, thus, would require additional treatment (Matsumoto and Martin 2015). Soil washing is not considered a viable option because of the estimated large volume of water and length of time required to complete the effort: approximately34 years and between 80,000 and 160,000 gallons per day of water would be required to treat all 881,000 cubic yards of soil (see Appendix D). Soil washing is normally performed as a volume reduction process to reduce the amount of material being disposed of as hazardous waste, not to remove all of the soil contaminants to background levels. In addition, either onsite treatment of the water for reuse or offsite disposal of the wash water would be required, and it is uncertain whether soil washing could meet AOC LUT values or other applicable cleanup requirements.
Phytoremediation and bioremediation	Use plants and/or soil organisms to remove or break down contaminants in the soil.	Studies determined that these processes were ineffective in removing or breaking down most of the constituents; however, natural attenuation may be useful for low concentrations of certain hydrocarbons (Nelson et al. 2015b, 2015c).

AOC = *Administrative Order on Consent for Remedial Action*; Boeing = The Boeing Company; CFR = *Code of Federal Regulations*; DTSC = Department of Toxic Substances Control; EIR = environmental impact report; EIS = environmental impact statement; ETEC = Energy Technology Engineering Center; LUT = Look-Up Table; NBZ = Northern Buffer Zone; NEPA = National Environmental Policy Act; NOI = Notice of Intent; RCRA = Resource Conservation and Recovery Act; ROD = Record of Decision; SRAM = *Final Standardized Risk Assessment Methodology Revision 2 Addendum, Santa Susana Field Laboratory, Ventura County, California*.

[a] Boeing and North American Land Trust recorded two Grant Deeds of Conservation Easement and Agreements (conservation easements) with Ventura County (Ventura County 2017a, 2017b) that permanently preserve as open space the land that Boeing owns at SSFL, including Area IV and the NBZ. The conservation easements are legally enforceable documents that forever prohibit residential, agricultural, or commercial development or uses of the site. Although Boeing's intended future land use is undeveloped open space, the human health impacts analysis in this EIS includes a hypothetical onsite suburban residential scenario (in addition to an open space scenario) that includes the direct exposure pathways of dermal chemical exposure, direct radiation exposure, inhalation of chemical and radioactive constituents, and incidental ingestion of chemical and radioactive constituents (MWH 2014). The hypothetical onsite suburban residential scenario is a more conservative scenario than that of open space; that is, it would yield higher potential human health impacts. Because the conservation easements restrict future land use and prohibit residential, agricultural, or commercial development or uses, DOE did not include the indirect garden pathway of ingestion of homegrown fruits and vegetables in the analysis of a hypothetical onsite suburban residential receptor.

S.10.2 Soil Remediation Alternatives

This section discusses the four soil remediation alternatives analyzed in this EIS: No Action Alternative, Cleanup to AOC LUT Values Alternative, Cleanup to Revised LUT Values Alternative, and Conservation of Natural Resources Alternative.

S.10.2.1 Soil No Action Alternative

Under the Soil No Action Alternative, no soil would be treated to reduce constituent concentrations to levels that would meet cleanup criteria or be removed for offsite disposal. Soil would be left in place in perpetuity. Over time, radioactive constituents would continue to decay, and some chemicals would be reduced through natural decomposition processes. Boeing is currently providing site

security for the entire SSFL site. If that were to change, then DOE, in accordance with its Atomic Energy Act responsibilities, would provide security at SSFL Area IV and the NBZ.

S.10.2.2 Cleanup to AOC Look-Up Table Values Alternative

Under this alternative, DOE would remediate soil in Area IV and the NBZ to meet the chemical and radionuclide cleanup LUT values established in accordance with the 2010 AOC. DOE's planning assumption for cleanup of Area IV and the NBZ is that building removal would be conducted during the first 2 to 3 years of the project, with soil remediation starting towards the end of the building removal activities. Soil removal would be the primary method for cleanup to the AOC LUT values, with onsite treatment (monitored natural attenuation) used where feasible for selected, low-concentration chemicals. Soil would be removed on a systematic basis until all of the soil removal required to meet AOC LUT values is accomplished. Approximately 90 acres of land would be disturbed and 881,000 cubic yards of soil would be removed and disposed of off site Up to 25 workers would be involved with soil removal activities at any one time, not including truck drivers hauling soil off site. Approximately 57,500 heavy-duty truck round trips over 26 years would be required to remove the soil for disposal under this alternative, although additional time could be necessary to allow for partially full trucks and weather delays, as well as to ensure restoration activities and onsite treatment methods are effective. As many as 43,100 heavy-duty truck round trips would be needed to bring backfill to the site. There would also be about 52 miscellaneous heavy-duty truck round trips (e.g., for delivering and removing soil remediation equipment).

Overview of Soil Remediation

DOE would begin soil remediation following completion of building demolition. **Figure S–4** shows the extent of the chemical and radioactive constituents above the AOC LUT values in the soil in Area IV and the NBZ. DOE's remediation responsibilities include the NBZ. However, a portion of the NBZ was impacted by chemicals carried from NASA facilities in Area II; these areas would be cleaned up by NASA. Based on analysis of more than 11,000 soil samples, for this EIS DOE has estimated that a volume of 1,616,000 cubic yards of soil does not meet the AOC LUT values (see **Table S–2**) (see Appendix D).[15] The most frequently observed chemical constituents include polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), chemicals detected as total petroleum hydrocarbons (TPH) dioxins, and metals (antimony, cadmium, chromium VI, mercury, selenium, and silver) (CDM Smith 2017). The most frequently observed radionuclide constituents are cesium-137 and strontium-90 (HGL 2012a). The estimated volume of soil requiring remediation was adjusted, as described below, to account for soil with low concentrations of constituents detected as TPH[16] that are naturally occurring or would be treated on site by monitored natural attenuation and areas in which an exemption process would be applied for the protection of biological and cultural resources.

[15] In the Draft EIS, DOE estimated the volume of soil that may not meet the AOC LUT values could range from 1,000,000 cubic yards to 2,500,000 cubic yards; the estimated volume that was the basis for analysis was 1,414,000 cubic yards. Based on additional evaluation and more detailed analysis of the sampling data using geographic information system analysis, DOE has refined its estimate of the volume of soil that exceeds AOC LUT values to 1,616,000 cubic yards (see Appendix D). To account for the uncertainty associated with estimating soil volume from sampling data and to ensure that the soil volume estimate would bound what would actually be removed, the volume estimate was increased by a factor of 20 percent.

[16] As used in this EIS, low concentrations are considered to be concentrations in soil that do not pose a threat to groundwater and therefore could be treated through natural attenuation. DOE included all soil in which chemicals detected as TPH were the only constituents above AOC LUT values in the estimated volume that would be left on site and believes that most of this soil would be appropriate for natural attenuation.

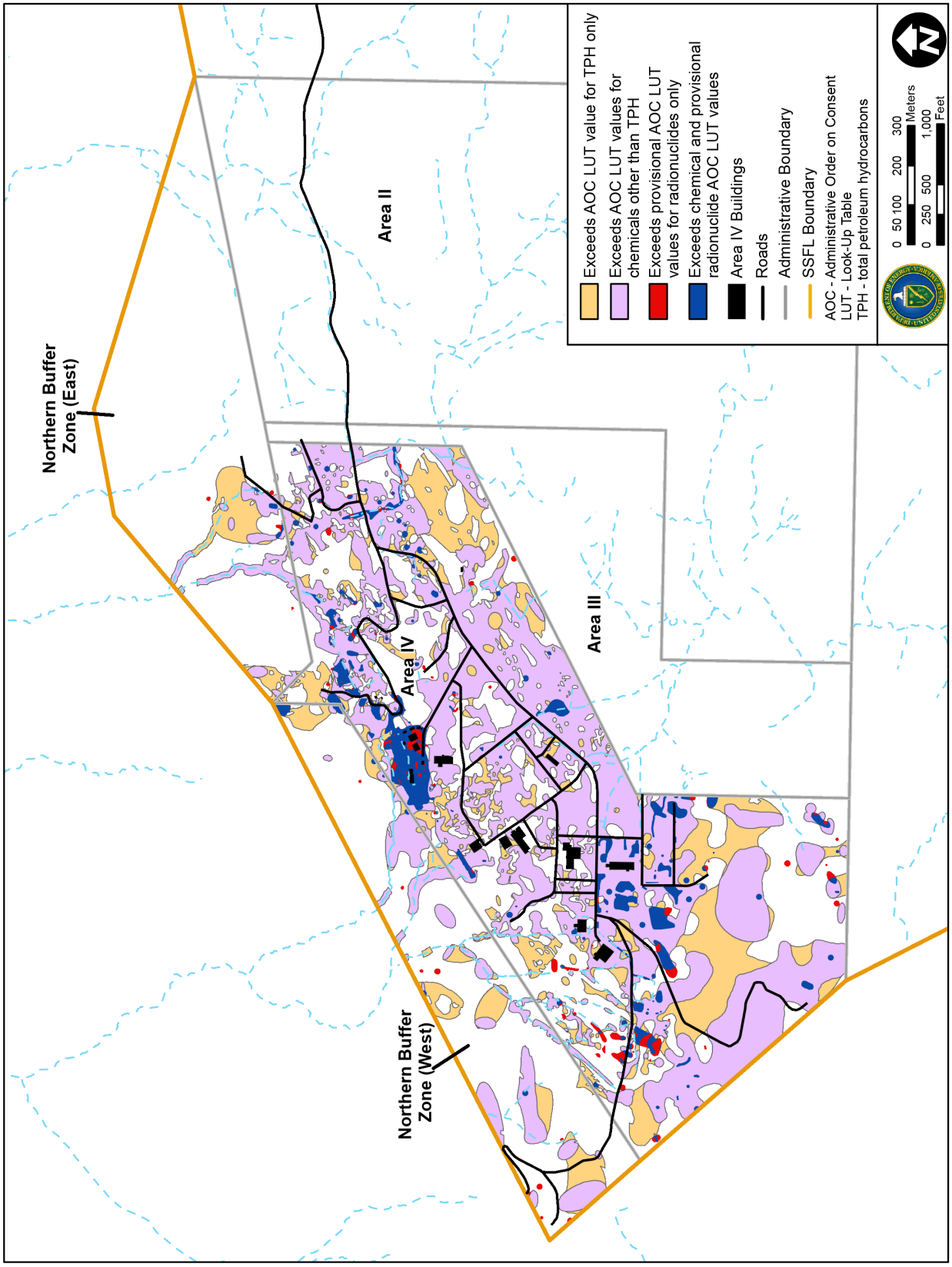

Figure S–4 Extent of Chemical and Radiological Constituents Above AOC Look-Up Table Values

Table S–2 Preliminary Estimated Soil Volumes for Remedial Actions per 2010 AOC Considerations

Soil Category Description	*Soil Volumes (cubic yards)*	*Area (acres)*
Estimated volume of soil exceeding the chemical AOC LUT values only (radionuclides below the AOC LUT values)	1,506,000	204
Estimated volume of soil exceeding the chemical AOC LUT values with radionuclides above the provisional AOC LUT values	106,000	15
Estimated volume of soil exceeding the provisional radionuclide AOC LUT values only (chemicals below the AOC LUT values)	4,000	3
Total volume of soil exceeding the chemical or radionuclide AOC LUT values	**1,616,000**	**222**
Volume of TPH soil potentially subject to monitored natural attenuation	620,000	54
Volume of soil for which the proposed biological and cultural exemptions process would be applied[a]	115,000	77
Total volume of soil potentially subject to removal	**881,000**	**90**

AOC = *Administrative Order on Consent for Remedial Action*; LUT = Look-Up Table; TPH = total petroleum hydrocarbons; PAH = polycyclic aromatic hydrocarbon.

[a] There is overlap between soils that exceed the AOC LUT value for TPH only and those in areas subject to the exemption process. The total volume and area of soil exceeding the AOC LUT value only for TPH is included in the above line. Entries on this line represent soils in areas in which the exemption process would be applied that exceed an AOC LUT value for constituents other than TPH.

Note: Sums presented in the table may differ from those calculated from table entries due to rounding.

Based on soil treatability studies, it was concluded that some of the soil characterized as exceeding TPH contains naturally occurring organic material and that accurately detecting TPHs at low concentrations is problematic. Both of these factors make concentrations of TPH appear higher than those attributable to petroleum-based origins (Nelson et al. 2015d; DTSC 2018). Soil treatability studies also concluded that natural attenuation (degradation) of chemicals has been occurring at SSFL since they were first released and predicted that natural processes will continue (Nelson et al. 2015a). These studies led DOE to conclude that natural attenuation will be able to reduce TPH concentrations adequately given sufficient time (CDM Smith 2015b; Nelson et al. 2015a). In its soil remediation plan submitted to DTSC for approval, DOE would propose use of onsite treatment (as allowed under the 2010 AOC) through monitored natural attenuation processes for low concentration TPH soil. The estimated volume of soil at locations with only TPH contamination is 620,000 cubic yards. This is an increase in the volume estimated for this soil type compared to that estimated in the Draft EIS (150,000 cubic yards). The increase is the result of two factors as discussed in Appendix D - additional analysis of available sampling data provided better delineation and separation of areas with only TPH and the current estimate includes TPH-only soils in areas in which the exemption process would be applied whereas the earlier estimate did not. Natural attenuation for this soil was assumed under all soil remediation alternatives; however, because there are natural sources (decaying organic matter) of chemical constituents detected as TPH (Nelson et al. 2015d), they are always being replaced and will never completely disappear.

The 2010 AOC (DTSC 2010a) provides for exemptions to protect biological resources, in accordance with the ESA, and "Native American artifacts that are formally recognized as Cultural Resources." In addition to explicitly recognizing the ESA, the 2010 AOC also acknowledges that DOE must comply with applicable local, State, and Federal laws and regulations. As a means of complying with other applicable laws and regulations related to protection of biological, DOE proposes application of the exemption process in additional locations in Area IV and the NBZ that include sensitive species and habitats protected under State and local regulations.

DOE consulted informally with the U.S. Fish and Wildlife Service (USFWS), the California Fish and Wildlife Service (CFWS), DTSC, and others starting in 2009 (see Appendix E) regarding protection of biological resources at SSFL. Informal consultation guided biological surveys at SSFL and led to

the development of a biological assessment. DOE initiated formal consultation with USFWS in 2018 in compliance with Section 7 of the ESA, which resulted in issuance of a USFWS biological opinion (see Appendix J) that defined an area in which the exemption process would be applied and establishes requirements for preservation of federally protected species in Area IV and the NBZ.

DOE's biological surveys also identified plant and wildlife species that have the potential to occur in Area IV or the NBZ and that have threatened, endangered, or rare status under the California ESA (including listed, proposed, and candidate species); are protected under the California Native Plant Protection Act, the Ventura County list of locally sensitive species, and the Bald and Golden Eagle Protection Act; or are classified as California Fully Protected Species or California Species of Special Concern. To comply with the laws and regulations for protecting these species, DOE proposes additional areas in which the exemption process would be applied. In addition to identifying areas within which the exemption process would be applied, potential suitable habitat for two federally listed species has been identified in Area IV or the NBZ. Neither species has been documented recently (within the last 5 years) on Area IV or the NBZ, but due to the possible long duration of the proposed project, habitat conditions may change and these species may use the site at some point during project implementation. As a result, potentially suitable habitat for these species has been identified and mapped (see Chapter 3, Section 3.5), but not included in the currently identified areas subject to the exemption process. If the areas identified as potential suitable habitat are occupied by federally listed species in the future, DOE would propose that the areas also be subject to the exemption process.

DOE is also consulting with the California State Historic Preservation Officer (SHPO), the Santa Ynez Band of Chumash Indians, non-federally recognized tribes, and other consulting parties to develop a programmatic agreement in accordance with NHPA, Section 106 that provides for the identification and evaluation of historic properties, determination of adverse effects on historic properties, and consultation concerning measures (e.g., avoid, minimize, or mitigate) to resolve any adverse effects on historic properties for the duration of the remediation process. Consultation regarding cultural resources is also to support DOE's determination of the eligibility of cultural resources at SSFL for listing in the NRHP or the *California Register of Historical Resources*.

Figure S–5 is a composite map of Area IV and the NBZ showing areas with chemical and radioactive constituents above the AOC LUT values overlain by locations proposed for application of the exemption process for protection of biological and cultural resources. To protect cultural resources in Area IV and the NBZ, their locations are not explicitly identified in Figure S–5. Most of the area identified for protection of cultural resources (6.2 acres) overlaps with areas in which the exemption process would be applied for protection of biological resources. Areas subject to the exemption process solely for cultural resources (less than 2 acres) account for less than 1 percent of the total area in which the exemption process would be applied. Within the areas in which the exemption process would be applied, DOE would remove soil containing chemical and radioactive constituents that pose a risk to human health or ecological resources as determined using a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) risk assessment, while minimizing disturbance to the surrounding areas.

As shown in Figure S–5, there are soils within the areas in which the exemption process would be applied that exceed the AOC LUT value for TPH only (tan areas in the figure). These TPH-only soils were discussed earlier in this section as soils that DOE proposes to leave them in place for monitored natural attenuation; consequently, the volume of soil subject to removal was reduced by 620,000 cubic yards. The incremental volume of soil within areas subject to the biological and cultural exemption process (non-TPH soil) that DOE proposes leaving in place is 115,000 cubic yards (see Appendix D).

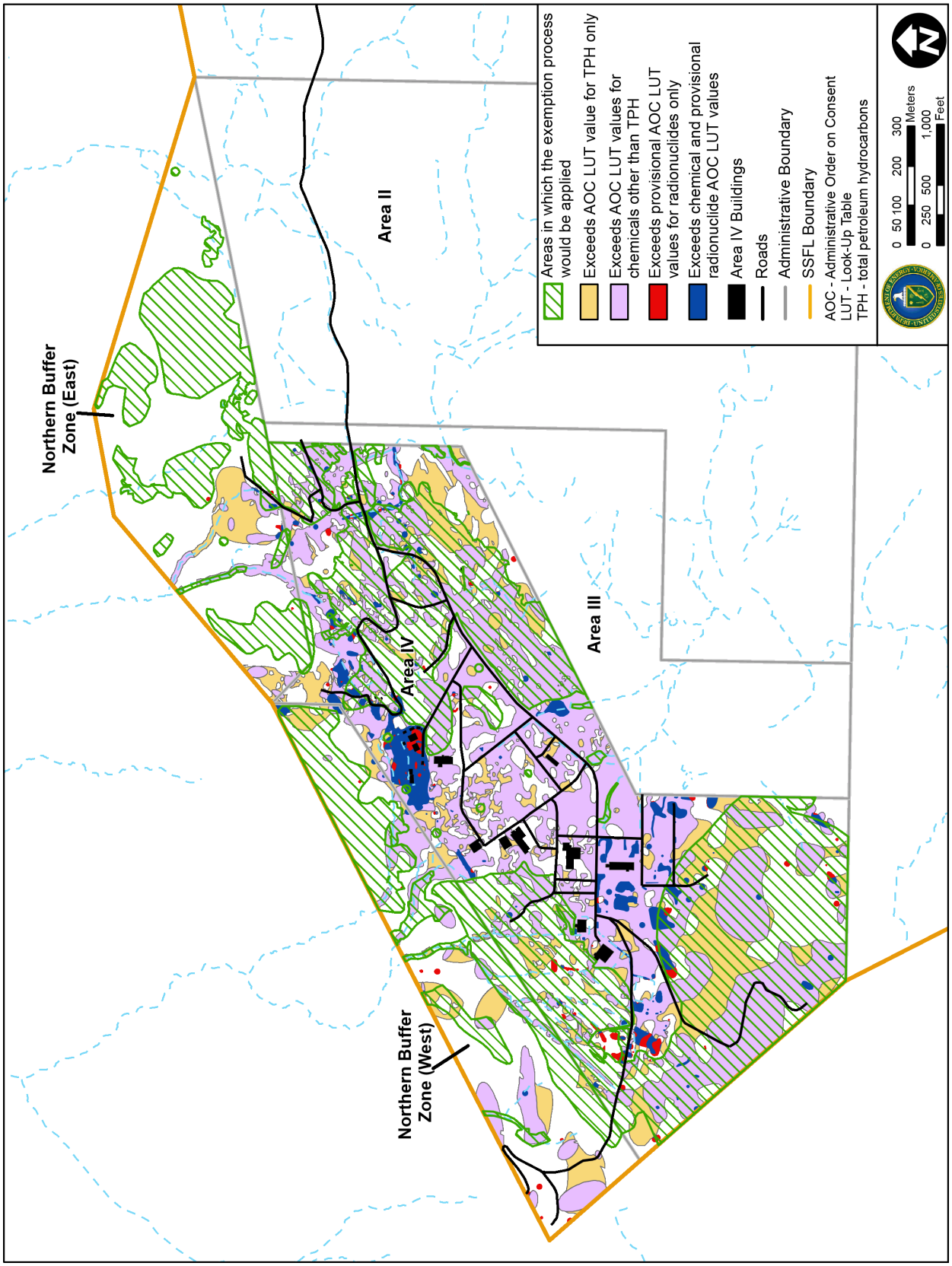

Figure S–5 Identification of Areas in which the Exemption Process would be Applied

As a result of these adjustments to the soil volume, 881,000 cubic yards of soil exceeding the AOC LUT values is considered in the Cleanup to AOC LUT Values Alternative (see Appendix D). Table S–2 summarizes the preliminary estimated soil volumes by 2010 AOC considerations.

The 2010 AOC also allows exemptions from soil remediation (up to 5 percent by volume) for unforeseen circumstances. DOE would propose use of these exemptions as necessary to prevent damage in remote locations and avoid areas that are too risky for workers to access. DOE may also propose use of the exemption for soil with constituents that are above the AOC LUT values, are deeper than 5 feet below ground surface, and do not threaten groundwater. Exemptions proposed for these purposes would be described in the forthcoming soil remediation plans to be submitted to DTSC for approval and were not used in developing the above adjustments to estimated soil volumes analyzed in this EIS.

The 2010 AOC (DTSC 2010a) stipulates that soils be cleaned up to LUT values that are local background concentrations or method/minimum detection limits for contaminants for which the method/minimum detection limits exceed background concentrations. Based on the chemical concentrations relative to hazardous waste criteria, risk-based concentrations, and the AOC LUT values, as well as the radionuclide concentrations relative to the provisional AOC LUT values, the following four categories of soil requiring disposal are expected to be removed during remediation efforts:

1. *Non-waste soil* – Soil containing chemical constituent concentrations below levels that would require disposal as a RCRA hazardous waste and below risk-based screening levels, but above the chemical AOC LUT values, and radionuclides at or below the provisional radiological AOC LUT values. This soil does not meet the definition of hazardous or radioactive waste and would be transported to a permitted California Class II or Class III[17] disposal facility, based on the acceptance criteria of the facility. At most sites in the United States, including California, this soil would be left in place (see Appendix D, Section D.3, for comparison with other cleanup projects in California).
2. *Moderate-risk soil* – Soil containing chemical constituent concentrations below levels that would require disposal as a RCRA hazardous waste, but above risk-based screening levels and radionuclide concentrations at or below the provisional radiological AOC LUT values. This soil does not meet the definition of hazardous or radioactive waste and would be transported to a permitted California Class II or Class III disposal facility, based on the acceptance criteria of the facility.
3. *Hazardous waste* – Soil containing chemical constituent concentrations that would require disposal as a RCRA hazardous waste and radionuclide concentrations at or below the provisional radiological AOC LUT values. This soil would be transported to a permitted California Class I or out-of-state hazardous waste disposal facility, based on the acceptance criteria of the facility.
4. *Low-level radioactive waste (LLW)/Mixed LLW (MLLW)* – Soil containing radionuclide concentrations above the provisional radiological AOC LUT values and any concentration of chemical constituents; this includes soil containing chemical concentrations expected to required disposal as a RCRA hazardous waste. This soil would be transported to a licensed commercial facility or authorized DOE facility for disposal as LLW or MLLW, based on concentration of chemical constituents and the acceptance criteria of the facility.

[17] Siting and construction requirements for California Class I landfills are similar to those for hazardous waste permitted under Subtitle C of RCRA (e.g., double composite liners and leachate collection systems). Siting and construction requirements for California Class II and Class III landfills are similar to those for nonhazardous waste permitted under Subtitle D of RCRA (e.g., liners and leachate collection systems), except additional requirements exist for Class II landfills compared to those for Class III landfills.

Table S–3 presents the preliminary estimates of soil volumes based on the soil categories for transportation and disposal considerations.

Table S–3 Preliminary Estimated Soil Volumes for Transportation and Disposal

Soil Category	*Soil Chemical/Radionuclide Classifications*	*Soil Volumes (cubic yards)*
1. Non-waste soil	Chemicals above AOC LUT values, but below risk-based screening levels and levels requiring disposal as a RCRA hazardous waste. Radionuclides at or below provisional AOC LUT values.	718,000
2. Moderate-risk soil	Chemicals above risk-based screening levels, but below levels requiring disposal as a RCRA hazardous waste. Radionuclides at or below provisional AOC LUT values.	51,000
3. Hazardous waste	Chemicals above levels expected to require disposal as a RCRA hazardous waste. Radionuclides at or below provisional AOC LUT values.	2,000
4. LLW/MLLW	Radionuclides above provisional AOC LUT values. Any concentration of chemicals. [a]	110,000
Total		**881,000**

AOC = *Administrative Order on Consent for Remedial Action*; LLW = low-level radioactive waste; LUT = Look-Up Table; MLLW = mixed low-level radioactive waste; RCRA = Resource Conservation and Recovery Act.

[a] Although most of the soil with radionuclides above provisional AOC LUT values also has chemicals above AOC LUT values, a total of 4,000 cubic yards of soil is estimated to exceed provisional radionuclide AOC LUT values only.

In accordance with the 2010 AOC, following soil removal, cleanup would be verified by DTSC for chemicals and EPA for radionuclides[18] before backfilling of the excavated areas would start. The verification process would involve collection of confirmatory samples following soil removal, analysis of the samples for constituents of concern, and transmission of the data to the agencies for their review. This verification process could take up to 6 weeks following soil removal.

DOE anticipates focusing initially on removing soil identified as exceeding the radiological AOC LUT values and soil that would require management as a RCRA hazardous waste. Following characterization and radiological surveys of the transportation containers and vehicles, these soils would be transported for disposal as LLW or MLLW at a licensed commercial facility or an authorized DOE facility, or as hazardous waste at a permitted commercial facility, respectively. DOE would then remove the remaining non-waste and moderate-risk soils which should require management only for chemical constituents that exceed the AOC LUT values. DOE would continue to perform radiological surveys as the remainder of the soil is excavated and packaged for shipment to identify any potential residual pockets of soil containing radioactive constituents.

For the purpose of analysis in this EIS, **Figure S–6** shows the locations in Area IV and the NBZ that would be cleaned up under the Cleanup to AOC LUT Values Alternative. As DOE develops its soil remediation plan for soil cleanup, the areas to be remediated will be refined (e.g., larger-scale, more-detailed maps showing expected remediation boundaries would be developed). The figure shows the locations that would be cleaned up within the areas in which the exemption process would be applied for protection of sensitive biological and cultural resources, as allowed under the 2010 AOC (DTSC 2010a). DOE would identify these areas and the rationale for their protection in a soil remediation plan that would be submitted to DTSC for approval prior to initiating remediation activities. The identified areas have been evaluated as posing a potential risk to human health or ecological resources, as determined using a risk assessment. The human health risk assessment is based on a residential receptor, without a garden. DOE would remove soil containing chemical and radioactive constituents in these areas through carefully planned, focused removals that would result in minimum disturbance.

[18] Future involvement by EPA (e.g., verification sampling) would be contingent on future agreements and funding.

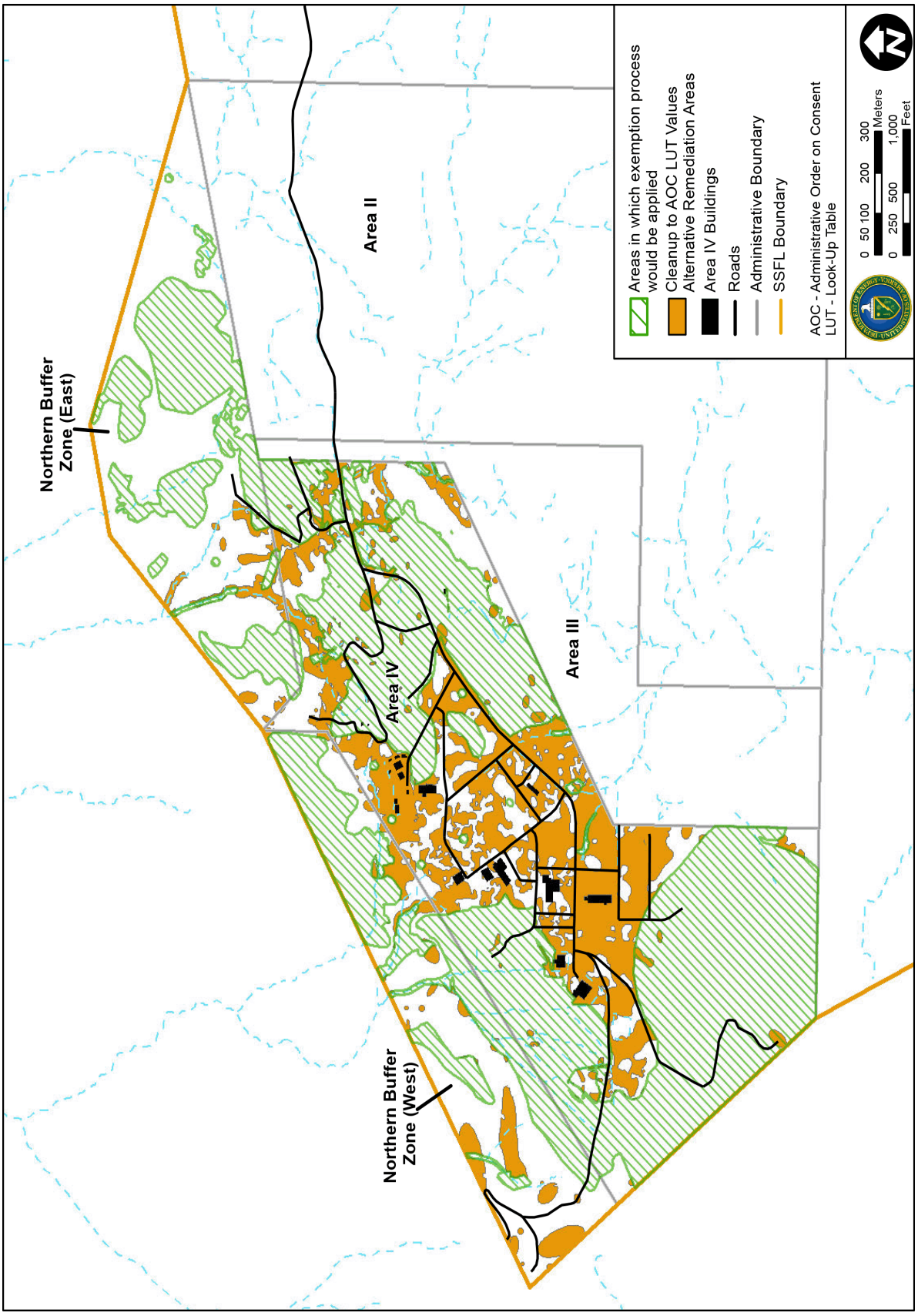

Figure S–6 Soil Remediation – Cleanup to AOC LUT Values Alternative

Following confirmation that cleanup standards have been met, excavated areas would be backfilled and graded, slopes would be stabilized, and disturbed areas would be revegetated using native plant species. It was assumed that approximately 75 percent of the soil volume removed would be backfilled to accomplish contouring and slope stabilization (see Appendix D). This would require transporting up to 661,000 cubic yards of backfill (if 881,000 cubic yards of soil were removed) to the site.

DOE conducted an initial evaluation of three off-SSFL sources of soil for backfill and found none that meets all of the requirements of the 2010 AOC (that the backfill meets the AOC LUT values) (see Appendix D). NASA has also tested soils from multiple offsite backfill locations in the region[19] and found that materials at these sites that might meet the AOC LUT values are predominantly a sand-and-gravel mixture with no materials capable of restoring excavated areas at SSFL to pre-cleanup conditions (NASA 2017). A sand and gravel mixture is not soil and, therefore, would most likely not support regrowth of native vegetation. In addition, DOE has had bags of soil from two home improvement stores analyzed. Many of the chemicals on the AOC LUT are ubiquitous and found in varying concentrations in soil. Analysis of the home improvement store soil found that both samples failed to meet the AOC LUT values (see Appendix D). Because the AOC LUT values are very low, finding soil of this purity, especially soil that is comparable to the existing local soil (i.e., that would support the native plant communities), is expected to remain a challenge. If a source of backfill soil that meets all of the AOC LUT values cannot be reasonably found, then DTSC, DOE, and EPA would enter into a consultation process, and DTSC would determine the best available source of backfill (DTSC 2010a).[20] DOE would not proceed with large-scale excavation of soil until an acceptable source of backfill material is identified.

Stormwater discharges from the entire SSFL site are regulated by a site-specific National Pollutant Discharge Elimination System (NPDES) permit and a California Regional Water Quality Control Board, Los Angeles Region, Order issued to Boeing, the landowner (CRWQCB 2007). To maintain compliance, Boeing has implemented a comprehensive, site-wide best management practices (BMP) program that utilizes both structural and nonstructural BMPs (Geosyntec 2012; MWH 2012). The existing NPDES stormwater control and monitoring system would remain in place during soil remediation and restoration. This stormwater control and monitoring system was designed to provide for the full treatment of runoff from 95 percent of the storms that could occur on site and partial treatment for the remaining 5 percent of the storms (Boeing 2008). DOE would coordinate with Boeing and schedule and perform its soil-disturbing work to minimize the potential to cause perturbations and permit exceedances.

DOE would apply a surfactant or soil binder to exposed areas to control dust and deploy wattles (long tubes of inert, usually natural materials such as straw that filter water and retain sediments) to control runoff. Foot and vehicle traffic in exposed areas would be restricted to maintain the surfactant crust. Following concurrence from DTSC and EPA that backfill soil is acceptable, DOE would place the backfill on the excavated areas and re-grade and recontour as necessary. The area would then be seeded with a native plant seed mixture. DOE would conduct vegetation monitoring per the Revegetation and Habitat Restoration Plan discussed in Chapter 6 of this EIS.

Evaluation of Implementation of 2010 AOC Cleanup Requirements

This section addresses the technical aspects of implementing the "cleanup to background" approach described in the 2010 AOC (DTSC 2010a) that compelled DOE to look at other soil cleanup

[19] NASA sampled borrow sites in addition to the borrow sites sampled by DOE and their analytical results showed constituents that exceeded LUT values for chemicals for all sites tested.

[20] On December 21, 2016, DOE sent a letter to DTSC describing DOE's efforts and difficulty in locating backfill soil that meets the 2010 AOC requirements and requesting initiation of the consultation process (DOE 2016).

alternatives beyond those described in Sections S.10.2.1 and S.10.2.2. In this section, DOE also considers its legal and regulatory responsibilities for considering alternative cleanup actions.

2010 AOC Soil Cleanup Standards

The soil cleanup standards specified in the 2010 AOC are based on "cleanup to background" for soil contaminants. The 2010 AOC stipulated that the soils cleanup standard would be based on LUT values, which are local background concentrations or method/minimum detection limits for constituents whose detection limits exceed local background concentrations (see Section S.4). The cleanup standard definition applies to chemical as well as radionuclide constituents found in Area IV and the NBZ. DTSC has established AOC LUT values for chemicals and provisional AOC LUT values for radionuclides based on either background concentrations or detection limits (see Appendix D).

Background concentrations and method/minimum detection limits are lower than what is typically used as a standard for soil cleanups. Most cleanups are based on a CERCLA risk assessment that follows EPA guidance. For example, the risk-based standard (based on the SRAM [MWH 2014]) for mercury is 16.8 parts per million, while the AOC LUT value is 0.13 parts per million. PCBs do not naturally occur, so they do not have a background concentration; therefore, the minimum detection limit is used for the AOC LUT value. For Aroclor 1254, one of the PCBs found in Area IV, the SRAM risk-based standard is 232 parts per billion, and the AOC LUT cleanup standard is 17 parts per billion. For petroleum hydrocarbons, the AOC LUT value is currently set at 5 parts per million; environmental screening levels normally used at other locations in California (SFWQCB 2013) and applicable to other cleanups (EPA 2015b) range from 100 to 500 parts per million. This 1 to 2 orders of magnitude (that is, 1 to 2 multiples of 10) difference between what is normally used in soil cleanup and the AOC LUT value occurs for most of the chemicals detected within Area IV and the NBZ.[21]

For cesium-137, the cleanup standard applied to Area IV soil removal actions (prior to establishment of the provisional radionuclide AOC LUT values per the 2010 AOC) was 9.2 picocuries per gram (Boeing 1999, 2000). The current DOE cleanup standard for cesium-137 in soil using a suburban residential land use scenario (consistent with the SRAM [MWH 2014]) corresponds to a soil concentration of 10.3 picocuries per gram. The provisional AOC LUT value for cesium-137 is 0.225 picocuries per gram.[22]

The 2010 AOC (DTSC 2010a) confirmation protocol compares every soil sample with the AOC LUT values for 116 chemicals and 16 radionuclides (see Appendix D). Should any chemical or radionuclide exceed its respective AOC LUT value, then the soil must be cleaned up. This EIS refers to this approach as a point-by-point cleanup process.

To understand how a point-by-point process would be implemented, DOE reviewed similar cleanup actions at other sites. While there are sites where point-by-point cleanups have been applied, these sites contained only a few chemicals or radionuclides of concern and not the large number of constituents (132) included in the AOC LUTs. DOE reviewed two large remediation projects in California—Hunters Point near San Francisco and McClellan Air Force Base near Sacramento, because they dealt with multiple contaminants. However, both of these cleanups were risk-assessment-based (not point-by-point decisions), were focused on about 30 constituents (not 132), and allowed leaving contamination in place. When there are only a few constituents and/or a risk assessment approach is used, a small number of constituents need to meet the established standard. Moreover, the AOC LUT values do not account for the natural occurrence of many constituents in

[21] See Appendix D, Table D–3, for a list of AOC LUT values for chemical constituents and the corresponding risk-based standards determined in accordance with the SRAM (MWH 2014).
[22] See Appendix D, Table D–2, for a list of provisional AOC LUT values for radioactive constituents.

the soil, meaning that they could lead to decisions to remove soil that has not been contaminated by Area IV operations. Therefore, meeting the 2010 AOC LUT values would require an unprecedented approach and effort.

High Level of Uncertainty in Cleanup Decisions

To be certain that what DOE is cleaning up is contamination resulting from ETEC operations, there must be confidence in the analytical result that the contaminants are actually present and their concentrations exceed the cleanup standard. The 2010 AOC specifies that the detection limits for the chemical AOC LUT values should be based on the "lowest concentrations at which an analyte can be confidently detected in a sample and its concentration can be reported with a reasonable degree of accuracy and precision." For many of the chemicals (e.g., PCBs) and radionuclides (e.g., strontium-90), however, the AOC LUT values are set at the lower end of the analytical instruments' abilities to accurately report the presence of the constituent. Exceeding such values does not necessarily indicate that contamination is present because some constituents may be at background levels. As a result, DOE may perform soil cleanup at locations where contamination does not exist.

Acceptable Error Rate

DTSC has set an acceptable error rate in sample analysis of 5 percent. This means that, for 100 soil samples analyzed for one chemical near the method/minimum detection limit, five sample analyses could falsely report the chemical's presence when it is not actually in the sample. A 5 percent error rate may be acceptable when the project involves only one chemical, but, AOC LUTs published by DTSC identify 116 chemicals and 16 radionuclides to be considered. Compounding a 5 percent error rate over 132 different potential constituents in each sample means a much greater chance that DOE would be remediating clean soil, not contaminated soil.

Background Data AOC LUT Failures

DTSC conducted a soil background study that involved collecting soil samples from two sites approximately 3 to 4 miles west of SSFL (URS 2012).[23] DTSC analyzed 148 soil samples for 110 different chemicals[24] and used this data set for development of the chemical AOC LUT values. Comparing the background soil results with the AOC LUT values, 46 of the 110 chemicals analyzed (42 percent) exceeded their respective AOC LUT values in at least one sample. This implies that, if the point-by-point, chemical-by-chemical process described in the 2010 AOC were applied to the background study locations, they would be declared contaminated and subject to soil remediation. It also demonstrates that it is difficult to differentiate background concentrations from contamination from ETEC operations based on the low AOC LUT values; thus, where to stop soil remediation cannot be clearly defined.

Total Petroleum Hydrocarbon AOC LUT Value

The AOC LUT value for TPH was set at 5 parts per million without considering its natural presence. The analytical method (EPA Method 8015) is not specific to TPH, but detects any chemical molecule, many of which naturally occur, within the carbon ranges of TPH. Therefore, for any soil sample analyzed for TPH, there is a high level of uncertainty regarding whether the result is actually TPH. In addition, the environmental screening levels normally used at other locations in California (SFWQCB 2013) and applicable to other cleanups (EPA 2015b) range from 100 to 500 parts per million; for this reason, analytical laboratories are not set up to analyze for TPH at 5 parts per million. DOE provided soil samples to two laboratories, and they could not reproduce TPH results below 100 parts per million

[23] URS Corporation was the DTSC contractor for the chemical characterization of off-SSFL reference areas. The characterization data provide background soil concentrations to which samples collected at SSFL can be compared.
[24] DTSC also analyzed samples for pH (acidity), but soil pH is not a parameter in the chemical AOC LUT.

(Nelson et al. 2015d). California Polytechnic State University, San Luis Obispo, evaluated the types of organic molecules in soil to demonstrate that the results being reported were not TPH. The study demonstrated that there are technical problems with measuring TPH concentrations at such low levels (Nelson et al. 2015d). A review of the TPH data produced for Area IV indicates that as much as 300 parts per million of the reported TPH in any given sample actually results from normally occurring organic materials and are not petroleum-related (Burgesser 2015).

Changes in Site Knowledge Since the Signing of the 2010 AOC

When the 2010 AOC (DTSC 2010a) was signed, there was a general belief that there was widespread radioactive contamination in Area IV. However, EPA's radiological study did not show that Area IV was highly contaminated. EPA concluded, "[a] majority of the Radiological Areas of Interest are congregated within specific areas or are associated with key facilities;" and, "Approximately 70 percent of soil samples with radionuclide concentrations greater than the FALs [field action levels][25] are located within five Area IV Radiological Areas of Interest: RMHF [Radioactive Materials Handling Facility] complex, SRE [Sodium Reactor Experiment] complex, 17th Street Drainage, Former Fuel Element Storage Facility, and New Conservation Yard Drainage" (HGL 2012a). Each of these areas were known to be impacted by radionuclides prior to EPA's study and had been subject to prior soil removal actions by DOE to an approximate 9.2 picocurie per gram cleanup standard (see, for example, Boeing 1999 and Boeing 2000). Review of data in the *Final Radiological Characterization of Soils, Area IV and the Northern Buffer Zone, Area IV Radiological Study, Santa Susana Field Laboratory, Ventura County, California* (HGL 2012a) showed that, of the over 3,500 soil samples analyzed by EPA, only about 12 percent of the samples exhibited radionuclide concentrations exceeding EPA's FALs. Cesium-137 and strontium-90 constituted 94 percent of the reported radionuclides, consistent with site knowledge prior to the EPA study. As a result, the EPA findings disproved the general belief that Area IV is highly contaminated by radionuclides throughout.

What was not clearly known at the time of the signing of the 2010 AOC was the extent of soil contamination by chemicals. The RCRA Facility Investigation (RFI) studies completed during the years 2000 through 2009 focused on chemical contamination associated with Solid Waste Management Units and Areas of Concern (CH2M Hill 2008, 2009; MWH 2006, 2007, 2009). The RFI studies were based on risk assessment standards, and the need to conduct extensive soil sampling away from the investigation areas was not warranted.

The AOC LUT values became the basis for soil investigations under the 2010 AOC. DOE concluded that low AOC LUT values, coupled with the false positive issues and the inability to accurately distinguish TPH from a range of other organic molecules (described above), resulted in data showing almost the entirety of Area IV to exceed an AOC LUT value for at least one chemical. In accordance with the 2010 AOC, soil exceeding the AOC LUT for even one chemical would require remediation. As a result, cleanup planning for Area IV and the NBZ was transformed from a mostly radiologically impacted soil cleanup (approximately 110,000 cubic yards) to a mostly chemically impacted soil cleanup (approximately 1,612,000 cubic yards), based on the chemical AOC LUT values (DTSC 2013b).

2010 AOC Backfill Soil Requirements

Attachment B (Final Agreement in Principle) of the 2010 AOC states the following with regard to use of backfill soil:

[25] EPA notes in its final soils report (HGL 2012b) that FALs do not consider EPA's recommended uncertainty factors, and locations with results exceeding the FALs "do not represent areas of contamination or areas of remediation." Nonetheless, the FALs were used during site characterization to identify areas of potential radiological contamination.

"Backfill/replacement soils must not exceed local background levels.

- Onsite soils that do not exceed local background levels may be used as backfill/replacement soils.
- Offsite soils that have been verified to not exceed local background levels may be used as backfill/replacement soils."

Attachment C (Confirmation Protocol "Not to Exceed" Background Cleanup Standard) of the 2010 AOC (DTSC 2010a) states:

"Backfill/replacement soils may be from onsite or offsite locations, with a preference for onsite locations. For purposes of this protocol, "onsite" locations are those within the geographic boundaries of the SSFL site)."

"For backfill soils obtained from outside the Santa Susana Field Lab, the relevant Look-up Table shall be for the formation to which the backfill soils are to be placed."

There are no onsite borrow sources for DOE's use at SSFL. Developing onsite borrow sources would add to potential biological impacts at SSFL. In February 2015, DOE conducted an initial evaluation of off-SSFL borrow sites for soil meeting the chemical AOC LUT values. The three evaluated sites failed to meet 2010 AOC requirements because multiple chemicals of concern exceeded the AOC LUT values (see Appendix D). In addition, DOE tested packaged soil products sold by home improvement stores. All products tested exceeded the AOC LUT values for multiple chemicals (see Appendix D). Based on this initial evaluation and given the low AOC LUT values, it appears unlikely that replacement soil meeting the AOC requirements can be found. If a soil were found that could meet the AOC LUT values, there is concern that the soil would not be comparable to the physical, chemical, and microbial characteristics of existing soil, making it difficult to re-establish native vegetation in Area IV and the NBZ.

NEPA Guidance and Regulations for Addressing Alternatives in EIS Documents

DOE consulted applicable CEQ and DOE NEPA regulations and guidance in determining reasonable alternatives to the cleanup to AOC LUT values for analysis in this EIS.

The CEQ NEPA regulations state that an EIS "shall inform [decision-makers] and the public of the reasonable alternatives which would avoid or minimize adverse impacts or enhance the quality of the human environment" (40 CFR 1502.1). In discussing the contents of an EIS, the regulations further indicate the importance of the analysis of alternatives:

> §1502.14 Alternatives including the proposed action. This section is the heart of the environmental impact statement…. In this section agencies shall:
>
> (a) Rigorously explore and objectively evaluate all reasonable alternatives, and for alternatives which were eliminated from detailed study, briefly discuss the reasons for their having been eliminated.
>
> (b) Devote substantial treatment to each alternative considered in detail including the proposed action so that reviewers may evaluate their comparative merits.

CEQ's "Forty Most Asked Questions Concerning CEQ's National Environmental Policy Act Regulations" (CEQ 1981) provides the following guidance:

- Range of Alternatives – "The phrase 'range of alternatives' refers to the alternatives discussed in environmental documents. It includes all reasonable alternatives, which must be rigorously explored and objectively evaluated. . ."

- Alternatives Outside of the Capability of Applicant or Jurisdiction of Agency – "Section 1502.14 [NEPA Regulations 40 CFR Parts 1500 – 1508] requires the EIS to examine all reasonable alternatives to the proposal. In determining the scope of alternatives to be considered, the emphasis is on what is 'reasonable' rather than on whether the proponent or applicant likes or is itself capable of carrying out a particular alternative. Reasonable alternatives include those that are practical or feasible from the technical and economic standpoint and using common sense, rather than simply desirable from the standpoint of the applicant."

2003 Litigation Involving ETEC

In addition to the 2010 AOC, this EIS responds to the outcome of a lawsuit filed by the Natural Resources Defense Council, the Committee to Bridge the Gap, and the City of Los Angeles, which challenged DOE's 2003 *ETEC EA* (DOE 2003) and Finding of No Significant Impact for remediation of Area IV in the U.S. District Court for the Northern District of California.

Potential Environmental Consequences of Cleanup to AOC LUT Values

As described in Chapter 4 of this EIS, the Cleanup to AOC LUT Values Alternative would result in appreciable resource use and waste generation. Characteristics of this alternative include:

- 90 acres of land disturbed in Area IV and the NBZ;
- 881,000 cubic yards of soil removed and 661,000 cubic yards of backfill emplaced, resulting in up to 101,000 heavy-duty truck round trips (13,000,000 to 45,000,000 million truck miles[26]);
- 162,500 round trips of cars or light-duty trucks primarily due to worker commutes;
- substantial increase in the wear on local roadways;
- about 45.5 million gallons of water used;
- 2.8 to 7.7 million gallons of fuel used for trucks and heavy equipment;[27] and
- 30,000 to 80,000 metric tons (total) of greenhouse gases (as carbon dioxide [CO_2]) generated.[28]

Disturbing 90 acres of land in order to remove 881,000 cubic yards of soil would kill plants and animals, destroy portions of their habitats, and require a substantial, focused, and prolonged effort to achieve revegetation and restoration. Habitat could also be affected by incompatible backfill and invasive species brought to SSFL in the 661,000 cubic yards of backfill or on vehicles. In addition, land disturbance would produce fugitive dust that could impact downwind onsite and offsite areas.

Transportation for disposal of 881,000 cubic yards of soil and 661,000 cubic yards of backfill would result in more than 101,000 heavy-duty truck trips (45,000,000 truck miles) over about 26 years and 162,500 round trips of cars or light-duty trucks would result in increases in traffic and noise on local roads. In addition, the increased traffic, in particular the heavy haul trucks, would accelerate road deterioration, requiring repair sooner than currently anticipated.

The 45.5 million gallons of water (used primarily for dust suppression) would represent an unnecessary use of a valuable resource in an area already stressed by drought. In addition, the irreversible consumption of 2.8 to 7.7 million gallons of fuel for truck transportation and heavy equipment use would contribute to the generation of a total of 30,000 to 80,000 metric tons of greenhouse gases.

[26] The large range in results from the analysis considering disposal in facilities near SSFL, as well as in facilities long distances from SSFL (for example, a hazardous waste disposal facility in Idaho).
[27] See preceding footnote.
[28] See preceding footnote.

S.10.2.3 Additional Soil Remediation Action Alternatives

This EIS includes two alternatives in addition to the Soil No Action and Cleanup to AOC LUT Values Alternatives discussed in the previous section. Under the Cleanup to Revised LUT Values Alternative, DOE would continue to apply cleanup criteria on a point-by-point basis, but would implement revised chemical constituent LUT values for making cleanup decisions (the radionuclide LUT values would be the same as under the Cleanup to AOC LUT Values Alternative). Under the Conservation of Natural Resources Alternative, DOE would apply a traditional risk-assessment approach to making cleanup decisions, including using area averaging to determine concentrations and developing risk and dose criteria, as described below. Under this alternative, DOE evaluates two future use scenarios: the Residential Scenario evaluates the hypothetical situation of a person living on site and the Open Space Scenario evaluates a situation consistent with Boeing's planned future use of the site as open space habitat (see Section S.5). DOE expects that it will need to engage DTSC in discussions about changes to the 2010 AOC in order to implement any soil remediation alternative. The 2010 AOC allows DOE and DTSC to agree upon changes to better meet cleanup objectives.

***SSFL Area IV EIS* Alternatives**

Soil Remediation Alternatives
- No Action
- Cleanup to AOC Look-Up Table Values Alternative
- Cleanup to Revised Look-Up Table Values Alternative
- Conservation of Natural Resources Alternative
  - Residential Scenario
  - Open Space Scenario

Building Demolition Alternatives
- No Action
- Building Removal Alternative

Groundwater Remediation Alternatives
- No Action
- Monitored Natural Attenuation Alternative
- Groundwater Treatment Alternative

Cleanup to Revised LUT Values Alternative

Under this alternative, a revised set of LUT values would be established for chemical constituents, and the LUT values for radioactive constituents would be the same as those under the Cleanup to AOC LUT Values Alternative. The revised chemical LUT values would be based on risk-based screening levels (RBSLs). The RBSLs would be calculated for the direct exposure pathways[29] of a hypothetical suburban residential land use scenario established for SSFL (MWH 2014), in which it is assumed that a receptor would be present on the remediated site 24 hours per day, 350 days per year, for 30 years. The revised LUT values for chemical constituents would be concentrations that correspond to a 1×10^{-6} (1 chance in 1 million) risk of developing a cancer and/or a toxicity hazard quotient[30] of 1. The lower of either the human health or ecological RBSL would be used for each constituent. However, if the RBSLs for a chemical are less than the corresponding AOC LUT value, the AOC LUT value would become the revised LUT value for that chemical.

As with the Cleanup to AOC LUT Values Alternative, DOE anticipates focusing initially on removing soil identified as exceeding the radiological AOC LUT values and soil that would require disposal as hazardous waste, prior to removal of the other soil types. Following characterization and radiological surveys of the transportation containers and vehicles, this soil would be transported off site for

[29] Direct exposure pathways include inhalation, incidental ingestion, and dermal contact with the chemicals in the soil. The indirect pathway of a garden from which the hypothetical suburban resident derives all of his or her fruits and vegetables is not included in the direct impacts analysis.

[30] Hazard index is the sum of hazard quotients of noncarcinogenic chemicals. A hazard index below 1.0 will likely not result in adverse noncancer health effects over a lifetime of exposure. A hazard quotient is a unitless value determined by: (1) dividing the exposure concentration by the EPA reference concentration for inhalation exposures, or (2) dividing the average daily dose by the EPA reference dose for oral exposures. The reference concentration (for inhalation) or reference dose (for ingestion) (reported in EPA's Integrated Risk Information System [EPA 2015a]) is an estimate of a continuous exposure of the human population (including sensitive subgroups) that will likely not result in adverse health over a lifetime of exposure.

disposal as LLW or MLLW or hazardous waste, respectively. Once soils in the areas identified as exceeding the AOC LUT values for radioactive constituents or chemical concentrations that would require management as hazardous waste are removed, the remaining soil should require management only for nonhazardous concentrations of chemical constituents. DOE would continue to perform radiological surveys of the remaining soil as it is excavated and packaged for shipment to ensure that if there are any residual pockets of soil containing radioactive constituents, they are detected and disposed of as LLW. As under the Cleanup to AOC LUT Values Alternative, cleanup decisions would be made on a point-by-point basis. That is, if the soil in a particular area exceeded the revised LUT value for any chemical or radioactive constituent, the soil would be removed. Within the areas in which the exemption process would be applied, soil would be removed if a CERCLA risk assessment indicates that it poses a risk to human health or ecological resources. Therefore, the volume of soil to be removed from areas subject to the exemption process would be the same as that under the Cleanup to AOC LUT Values Alternative.

Approximately 190,000 cubic yards of soil would be removed under this alternative. For the purpose of analysis in this EIS, **Figure S–7** shows the extent of chemical and radioactive constituents above the revised LUT values that would be remediated and those areas from which soil would be removed in the areas in which the exemption process would be applied. As DOE develops its soil remediation plan for soil cleanup, the areas to be remediated will be refined (e.g., larger-scale, more-detailed maps showing expected remediation boundaries would be developed). Approximately 12,400 heavy-duty truck round trips over about 6 years would be required to remove the soil for disposal under this alternative, although additional time could be necessary to allow for partially full trucks and weather delays, as well as to ensure restoration activities are effective. Approximately 9,300 heavy-duty truck round trips (rounded value) would be needed to bring 143,000 cubic yards of backfill to the site. There would also be about 52 miscellaneous heavy-duty truck round trips (e.g., for delivering and removing soil remediation equipment).

Some, but not all, of the issues associated with implementing the Cleanup to AOC LUT Values Alternative would also affect the Cleanup to Revised LUT Values Alternative. Like the Cleanup to AOC LUT Values Alternative, this alternative would require point-by-point decisions on individual constituents. However, each sample would have to meet the revised LUT values for 50 constituents (34 chemicals[31] that exceed risk-based screening levels and 16 radionuclides). If any one of the constituents were to exceed its respective revised LUT value, DOE would make a decision to remediate the area represented by the sample. Although fewer constituents would need to be evaluated under the Cleanup to Revised LUT Values Alternative, the point-by-point cleanup decisions would be subject to issues similar to those under the Cleanup to AOC LUT Values Alternative. Specifically, if any one constituent fails to meet its revised LUT value, a cleanup decision would be required. Although the decision thresholds would be higher, the potential for false positives introduces uncertainty in determining whether detection of a constituent actually represents contamination from ETEC operations (see Section S.10.2.2). Under this alternative, a smaller volume of backfill would be needed (143,000 cubic yards), and the chemical LUT values applicable to the backfill would be less restrictive than those under the Cleanup to AOC LUT Values Alternative. As

[31] The number of chemicals in the revised LUT (34) is much smaller than the number in the 2010 AOC LUT (116). One reason is that the AOC LUT (DTSC 2013b) includes chemicals that were never detected in Area IV or the NBZ as indicated in the *Draft Chemical Data Summary Report, Santa Susana Field Laboratory, Ventura County, California* (CDM Smith 2017). The chemicals included in the revised LUT are those that exceed their respective suburban resident (without a garden) RBSL in more than 1 percent of the site characterization sample results, as well as others that were detected in multiple samples in a small area (i.e., hot spots). Refer to Appendix D for a comparison of the chemicals included in the risk analysis under each soil remediation action alternative.

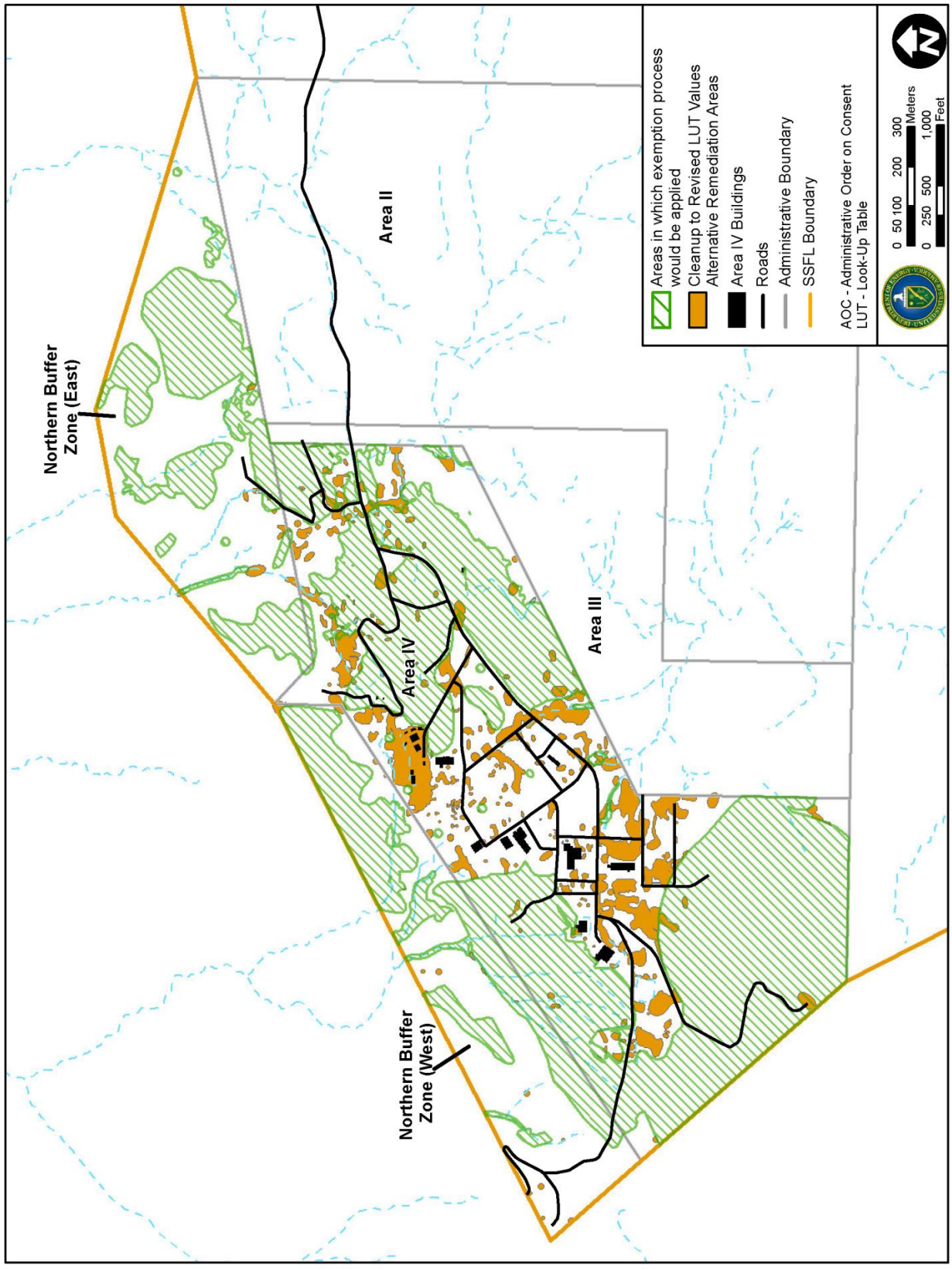

Figure S–7 Soil Remediation – Cleanup to Revised LUT Values Alternative with Proposed Exemption Areas

with the Cleanup to AOC LUT Values Alternative, finding a source of backfill that has the physical, chemical, and microbial characteristics that would support establishment of native vegetation may be a challenge. A search for such soil would be conducted in support of project implementation.

Conservation of Natural Resources Alternative

Under this alternative, DOE would remediate Area IV and the NBZ to reduce the concentrations of chemical and radioactive constituents in the soil to levels necessary to protect human health and ecological resources. This alternative reduces risk to the public and the environment, yet conserves natural resources, including biological, cultural, and water resources. Two scenarios are evaluated under this alternative, a Residential Scenario and an Open Space Scenario. The human health risk assessments differ between the two scenarios, resulting in different cleanup levels. However, under both scenarios, the same ecological risk assessment was performed to evaluate the potential effects of chemical and radionuclides in the soil on biotic receptors. Cleanup is determined by whichever risk assessment (human health or ecological) results in the lower concentration allowed to remain in the soil. For either alternative, there would be about 52 miscellaneous heavy-duty truck round trips (e.g., for delivering and removing soil remediation equipment) in addition to the number of truck round trips identified below for each scenario.

Residential Scenario—For the Residential Scenario, the hypothetical onsite suburban residential exposure scenario (using the direct pathways) as identified in the SRAM (MWH 2014) was selected as the basis for the human health risk assessment (risk assessments were performed following more-current EPA guidance). Cleanup would be targeted at locations posing risk based on the outcome of a risk assessment. Area IV and the NBZ would be subdivided into smaller areas or units over which concentrations would be averaged for purposes of evaluating risk. For each unit, risk assessment calculations would be performed individually for each chemical, and then the results summed to determine the risk value or hazard index. The risk results for each unit would be compared with the target risk range for alternatives of 1×10^{-6} to 1×10^{-4} (1 chance in 10,000 to 1 chance in 1 million) for cancer-causing chemicals and/or to a hazard index of 1 for noncarcinogenic chemicals to make decisions regarding cleanup of the contaminated soil. DOE would cleanup soil with chemical concentrations that exceed the risk assessment criteria and dispose of it in accordance with applicable requirements. In developing this Final EIS, DOE conducted risk assessments for 19 of the 156 assessment units into which Area IV and the NBZ were divided. The 19 units were selected because they represented the areas with the highest concentrations of chemical or radioactive constituents and/or because they had the highest density of samples exceeding an RBSL. An additional 51 assessment units were evaluated with respect to whether sample results in those units exceeded RBSLs and were similar to the 19 units for which risk assessments were performed. Soil with radioactive constituents would be remediated to meet the target risk range of 1×10^{-6} to 1×10^{-4}, although, based on the risk assessments and evaluations completed for this EIS, it appears that removing soil based on chemical risk also removes most of the radionuclides that would present sufficient risk to warrant removal. The concentrations of radionuclides in soil that would remain on site are expected to be considered as low as reasonably achievable (ALARA),[32] and well below the

[32] ALARA is based on the system of dose limitation recommended in International Commission on Radiological Protection (ICRP) Publication 26: "all exposures shall be kept as low as reasonably achievable, economic and social factors taken into account" (ICRP 1977). In ICRP Publication 37 (ICRP 1983), this component was referred to as "the optimization of radiation protection." ALARA is an approach to radiation protection to manage and control releases of radioactive material to the environment and exposure to members of the public and the work force so that levels are as low as reasonable, taking into account societal, environmental, technical, economic, and public policy considerations. As used in DOE Order 458.1, *Radiation Protection of the Public and the Environment* (DOE 2011a), ALARA is not a specific release or dose limit, but a process whose goal is to optimize control and management of releases of radioactive material to the environment and doses so that they are as far below the applicable limits of the order as reasonably achievable.

DOE standard of 25 millirem per year (DOE Order 458.1) for exposure of the hypothetical onsite suburban resident.

For the purpose of analysis in this EIS, **Figure S–8** shows the extent of soil removal that would be required under the Residential Scenario. As DOE develops its soil remediation plan for soil cleanup, the areas to be remediated would be refined (e.g., larger-scale, more-detailed maps showing expected remediation boundaries would be developed). This scenario would avoid the excavation and offsite transport of soil with concentrations that are less than risk-based levels. Because cleanup in areas in which the exemption process would be applied would be based on a risk assessment approach, the locations requiring cleanup in areas subject to the exemption process under this scenario would be the same as those under the two previous alternatives. Approximately 52,000 cubic yards of soil would be removed for offsite disposal (see Table S–4 in Section S.10.2.5). Approximately 3,400 heavy-duty truck round trips over about 2 years would be required to remove the soil for disposal under this scenario, although additional time could be necessary to allow for partially full trucks and weather delays, as well as to ensure restoration activities are effective. As many as 2,500 heavy-duty truck round trips (rounded value) would be needed to bring 39,000 cubic yards of backfill to the site.

Open Space Scenario—The Open Space Scenario is based on an exposure scenario consistent with Boeing's future plans for the land in Area IV and the NBZ. Boeing and the North American Land Trust recorded Grant Deeds of Conservation Easement and Agreements to permanently preserve land at SSFL as open space (Ventura County 2017a, 2017b). The conservation easements are legally enforceable documents that, among other restrictions, forever prohibit residential, agricultural, or commercial development or use of the site. Because there would be no permanent structures on the site, a recreational user scenario was used to evaluate the level of cleanup appropriate for use of Area IV and the NBZ as open space. The recreational user is assumed to visit the site 75 days per year and spend 8 hours on site on each visit over a period of 30 years. Exposure would be through the direct pathways of inhalation, inadvertent ingestion, and dermal contact (for chemicals) or direct exposure (for radionuclides). As with the Residential Scenario, risk assessments would be performed for each unit and results of the analysis for each constituent would be summed to determine a risk value or hazard index. The risk results for each unit would be compared with the target risk range for alternatives of 1×10^{-6} to 1×10^{-4} (1 chance in 10,000 to 1 chance in 1 million) for cancer-causing chemicals and/or to a hazard index of 1 for noncarcinogenic chemicals to make decisions regarding cleanup of the contaminated soil.

For the purpose of analysis in this EIS, **Figure S–9** shows the extent of soil removal that would be required under the Open Space Scenario. As DOE develops its soil remediation plan for soil cleanup, the areas to be remediated would be refined. As with the Residential Scenario, this scenario would avoid the excavation and offsite transport of soil with concentrations that are less than risk-based levels. Because the human health risk levels are based on the amount of time spent on site, the quantity of soil removed under this scenario would be less than that removed under the Residential Scenario. Cleanup in areas in which the exemption process would be applied would be the same as the Residential Scenario and the two previous alternatives. Approximately 38,200 cubic yards of soil would be removed for offsite disposal (see Table S–4 in Section S.10.2.5). Approximately 2,500 heavy-duty truck round trips over less than 2 years would be required to remove the soil for disposal under this scenario, although additional time could be necessary to allow for partially full trucks and weather delays, as well as to ensure restoration activities are effective. As many as 1,900 heavy-duty truck round trips (rounded value) would be needed to bring 29,000 cubic yards of backfill to the site.

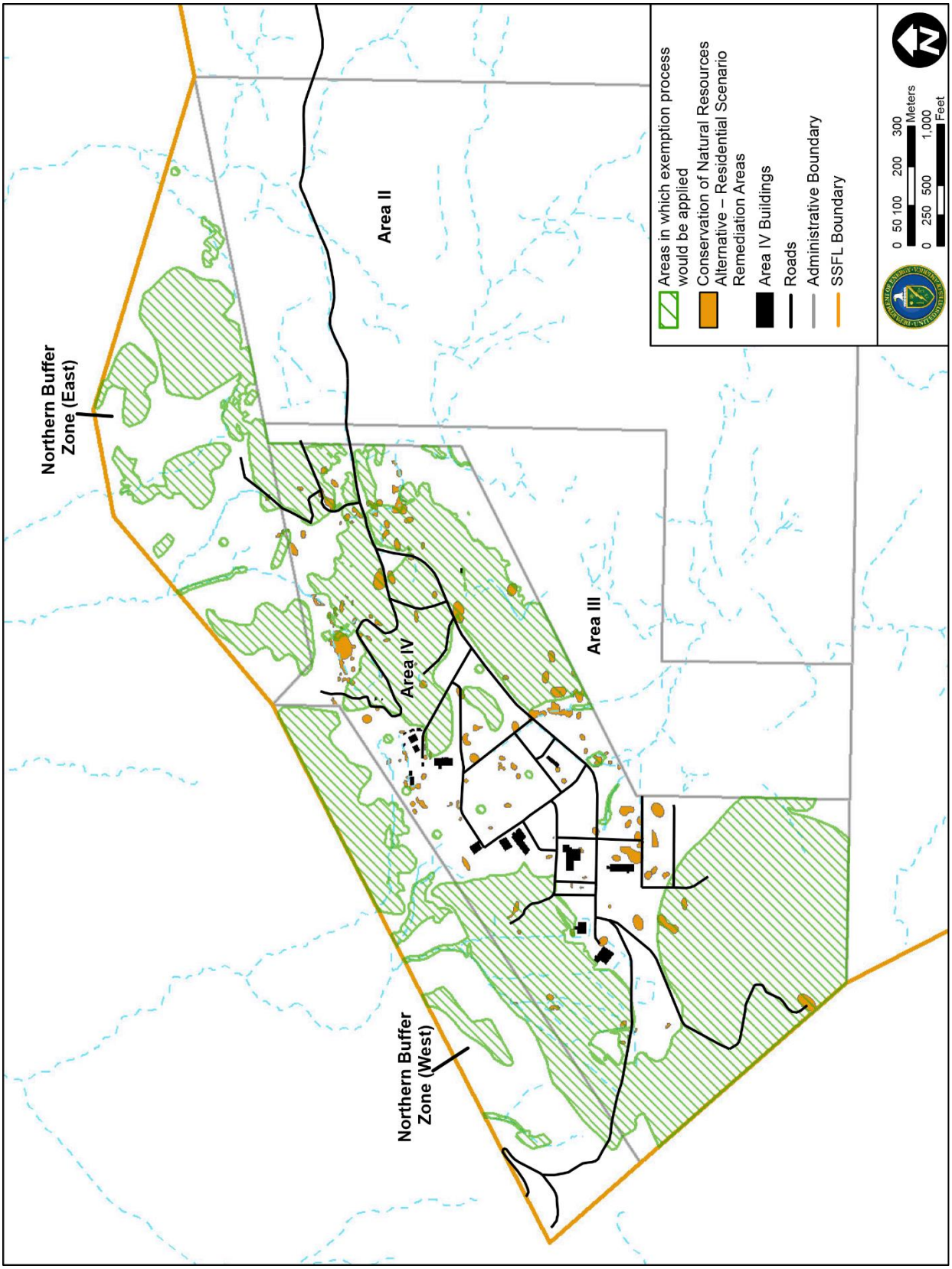

Figure S–8 Soil Remediation – Conservation of Natural Resources Alternative – Residential Scenario

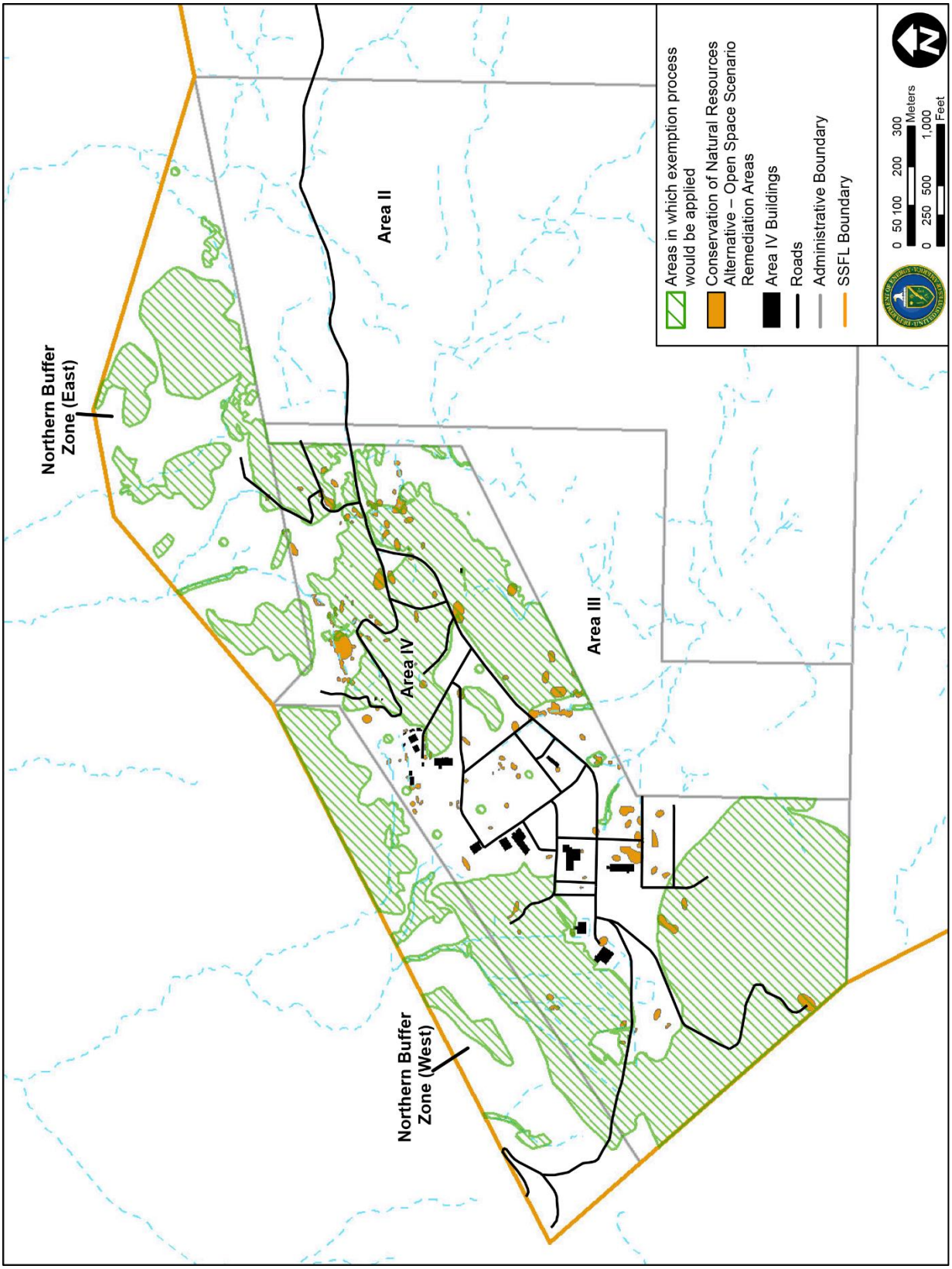

Figure S–9 Soil Remediation – Conservation of Natural Resources Alternative – Open Space Scenario

Cleanup based on CERCLA risk assessments for individual units accounts for the receptor's exposure to an average concentration in the unit in contrast to the point-by-point evaluation of the Cleanup to AOC LUT Values Alternative and the Cleanup to Revised LUT Values Alternative, where each sample must meet the LUT values for each constituent.

Implementation of either of the Conservation of Natural Resources Alternative scenarios would entail different issues than implementation of either the Cleanup to AOC LUT Values Alternative or Cleanup to Revised LUT Values Alternative. DOE would divide Area IV and the NBZ into risk assessment units and evaluate those units against risk criteria. An assessment of each area would be required to determine the relative quantities of chemicals and/or radionuclides that would trigger a cleanup decision. Rather than a single number for a given constituent across the entire Area IV and NBZ, the value that would result in cleanup has to be considered in concert with other constituents in an assessment unit to determine whether soil meets the cleanup targets (i.e., a cancer risk of 1×10^{-6} to 1×10^{-4} [a lifetime chance of 1 in 10,000 to 1 in 1 million of developing a cancer] and a hazard index of 1 [the level below which no toxic effects would be expected]). The approach of averaging the concentrations of constituents across assessment units has the potential of leaving localized areas of contamination that would be removed under a point-by-point cleanup like the Cleanup to AOC LUT Values Alternative or Cleanup to Revised LUT Values Alternative. Although a smaller volume of backfill would be required (29,000 to 39,000 cubic yards), and the allowable concentrations of chemical and radionuclides would be less restrictive than those for the Cleanup to AOC LUT Values Alternative, finding a backfill source that has the physical, chemical, and microbial characteristics that would support establishment of native vegetation may still be a challenge. A search for such soil would be conducted in support of project implementation.

S.10.2.4 Soil Remediation Sensitivity Evaluation

DOE recognizes that this EIS presents data and analyses that reflect the current state of knowledge and planning at the time the EIS is prepared. To assess the effects of recognized uncertainties and in response to comments on the Draft EIS, DOE performed sensitivity evaluations to assess the effect that certain uncertainties would have on potential environmental consequences (see Appendix L).

A sensitivity evaluation was performed using the Cleanup to AOC LUT Values as the base case, but addressing comments that the volume of soil assumed to be cleaned up may be too small or that additional cleanup should be conducted in the areas in which the exemption process would be applied. This sensitivity analysis evaluates impacts of what DOE believes would be the largest reasonably foreseeable volume of soil being removed from Area IV and the NBZ. The volume of soil to be removed includes that from all areas exceeding AOC LUT values, that is, no areas would be subject to an exemption process and all soil exceeding the AOC LUT value for TPH would not be left on site to naturally attenuate. This sensitivity evaluation considers removal of 1,616,000 cubic yards of soil over 47 years compared to 881,000 cubic yards of soil removed over 26 years under the Cleanup to AOC LUT Values Alternative.

Other sensitivity evaluations were performed using each soil remediation action alternative as the base case against which the effects of events that could constrain the pace of cleanup were evaluated. Events that could constrain the pace of cleanup include the availability of Federal funding for remediation or weather events. The sensitivity evaluations assume the same volume of soil is removed under each of the soil remediation action alternatives and scenarios, but removal occurs at half the rate assumed in the base case analyses; that is, the average number of heavy-duty truck round trips per day would be 8, rather than 16. The result is a doubling of the duration of the cleanup – the Constrained Scenario of the Cleanup to AOC LUT Values Alternative would take about 51 years rather than 26 years as evaluated for that alternative; the Constrained Scenario of the Cleanup to Revised LUT Values Alternative would take about 11 years rather than 6 years; and the Constrained

Scenarios of the Conservation of Natural Resources Alternative (both the Residential and Open Space Scenarios) would take about 3 years instead of 2 years.

S.10.2.5 Summary of Soil Remediation Alternatives

It is DOE's policy that work be conducted safely and efficiently and in a manner that ensures protection of workers, the public, and the environment. To achieve this policy for SSFL remediation, effective safety requirements and goals would be established through the adoption of applicable national and international consensus standards and where necessary to address unique conditions, through development and implementation of additional standards. DOE would implement Integrated Safety Management in accordance with DOE directives and include related requirements in remediation contractor contracts.

DOE's ultimate goal is zero accidents, work-related injuries and illnesses, regulatory violations, and reportable environmental releases. DOE would ensure that for all activities and phases in the remediation of SSFL, appropriate mechanisms are in place to ensure that exposures to workers, the public, and the environment to radiological and nonradiological hazards are maintained below regulatory limits. Furthermore, DOE would ensure that deliberate efforts are taken to keep exposures to radiation ALARA, consistent with DOE Order 458.1 and 10 CFR 835.

As described in the preceding sections, DOE evaluated the No Action Alternative and three action alternatives (one of which has two scenarios) for soil cleanup within Area IV and the NBZ. Regardless of the action alternative/scenario, in its soil remediation plan submitted to DTSC for approval, DOE would propose the use of monitored natural attenuation for the onsite treatment of 620,000 cubic yards of soil containing TPH. DOE would also propose that areas identified for the application of the exemption process for protection of biological and cultural resources would be remediated to a level determined through a risk assessment. Consequently, cleanup in the areas in which the exemption process would be applied would be the same under all action alternatives/scenarios.

- No Action Alternative – DOE would continue monitoring and maintenance activities and ensure that site security is maintained. There would be no treatment of soil to reduce constituent concentrations or removal of soil for disposal off site. Soil would be left in place in perpetuity.
- Cleanup to AOC LUT Values Alternative – DOE would selectively remove soil requiring disposal as LLW or MLLW or hazardous waste prior to focusing on removal soil containing only chemical constituents (that do not require disposal as hazardous waste). Remediation would proceed across Area IV and the NBZ, with removal of soil exceeding the AOC LUT values based on a point-by-point determination. An estimated 881,000 cubic yards of soil would be removed from the site over a 26-year time frame. The number of heavy-duty truck round trips (rounded values) would be about 57,500 for removing soil from the site and 43,100 for transporting backfill to the site.
- Cleanup to Revised LUT Values Alternative – DOE would remove soil exceeding the revised LUT values. Chemical cleanup levels would be based on the direct exposure pathways for the hypothetical onsite suburban residential scenario, as outlined in the SRAM (MWH 2014). Levels would be based on a cancer incidence risk of 1 chance in 1 million and a hazard quotient of 1. The radionuclide LUT values would be the same as those for the Cleanup to AOC LUT Values Alternative. DOE would selectively remove soil requiring disposal as LLW or MLLW or hazardous waste prior to focusing on removal of soil containing only chemical constituents (that do not require disposal as hazardous waste). As with the Cleanup to AOC LUT Values Alternative, DOE would make soil remediation decisions on a point-by-point basis. An estimated 190,000 cubic yards of soil would be removed from the site over about a 6-year time

frame. The number of truck round trips (rounded values) would be about 12,400 for removing soil from the site and 9,300 for transporting backfill to the site.

- Conservation of Natural Resources Alternative – DOE would clean up soil to a level that would protect human health and the environment by removing soil with concentrations of chemical or radioactive constituents that exceed criteria established using a risk assessment process. This alternative would reduce risk to the public and the environment, yet conserve natural resources by disturbing less land than the other alternatives, thereby reducing the potential of impacting visual, biological, cultural, and water resources. Two cleanup scenarios are evaluated. Under the Residential Scenario, cleanup levels would be based on a hypothetical onsite suburban residential scenario, as outlined in the SRAM (MWH 2014), as well as ecological risk. Under the Open Space Scenario, cleanup levels would be based on an onsite recreational user scenario and ecological risk. Constituent concentrations would be averaged over a risk assessment area or unit, consistent with standard risk assessment practice.[33] Chemically and radiologically impacted soil would be removed to achieve a cancer incidence risk of 1 chance 10,000 to 1 chance in 1 million and a hazard index of 1. Following cleanup of radiologically impacted soil to meet the risk range, the dose from soil remaining on site would be well below the dose constraint of 25 millirem per year. Under the Residential Scenario an estimated 52,000 cubic yards of soil would be removed from the site in about a 2-year time frame. The number of heavy-duty truck round trips (rounded values) would be about 3,400 for removing soil from the site and 2,500 for transporting backfill to the site. Under the Open Space Scenario, an estimated 38,200 cubic yards of soil would be removed from the site in less than 2 years. The number of truck round trips (rounded values) would be about 2,500 for removing soil from the site and 1,900 for transporting backfill to the site.

Each of the soil remediation action alternatives would require approximately 1.75 million gallons of water each year for dust suppression during soil excavation and loading of trucks. Although the annual need is within the Calleguas Municipal Water District's (CMWD) current capacity, water use is an important consideration in the comparison of soil remediation alternatives, given the continuing drought conditions in Southern California and other uses of this resource.

Similarly, regardless of the soil remediation action alternative that DOE may select, transportation of material to and from SSFL is a key issue. Each of the action alternatives would include transportation of large quantities of soil to offsite disposal facilities, as well as large quantities of backfill to Area IV. Whereas there are major highways north and south of SSFL, access to and from those highways requires travel on local roadways through commercial and residential areas. The section of roadway nearest SSFL over which all traffic to and from SSFL would pass is a 2.5-mile-long, two-lane road (Woolsey Canyon Road). Woolsey Canyon Road[34] would be used by all large vehicles and most personal vehicles accessing SSFL in support of DOE, NASA, and Boeing as each is responsible for implementing its respective SSFL remediation activities.

Contaminated soil would be transported off site for disposal in haul trucks with a 23-ton payload. Trucks would be covered or other appropriate methods would be used to minimize dust and contain the contents while in transit to disposal destinations. DOE would consider use of alternative-energy-fueled vehicles, if available and practicable, to minimize transportation impacts.

---

[33] Risk assessments evaluating onsite impacts in this Final EIS were performed following EPA guidance and using more-recent risk assessment modeling parameters than are included in the SRAM.

[34] Woolsey Canyon Road is the only serviceable road for heavy truck traffic to and from SSFL. The pavement on Woolsey Canyon Road shows few signs of structural failure, but is showing signs of age and brittleness, indicating that the pavement is near the end of its useful life. Portions of the roadway have recently been repaired.

DOE, NASA, and Boeing, have responsibility for cleaning up their respective portions of SSFL and may do so simultaneously until each has completed its effort. Because of the large number of heavy-duty trucks that would be required and concern regarding how many trucks could reasonably and safely be accommodated on the main access road to SSFL, DOE, NASA, and Boeing have entered into an agreement that establishes the total number of truck round trips that would be allowed daily and how those trips would be apportioned among them (Boeing 2015).

The agreement allows a maximum of 96 truck round trips at SSFL each workday (Monday through Friday), equally divided among the entities engaged in cleanup activities. The number of trucks that would transport materials each day would depend on a number of factors: the building demolition rate, the soil excavation rate, and the truck staging and loading rate; the distance to the disposal sites; the availability of trucks; and project funding. Under the agreement, as the number of entities involved in cleanup decreases, the number of truck round trips available to the remaining entities would increase. In this EIS, DOE assumes that it would require an average of 16 heavy-duty truck round trips daily for soil removal.[35] Even though there may be variations in daily use and occasional truck trips for deliveries and other remediation activities, DOE expects its number of daily truck round trips to occasionally approach 24 and to always be within its 32-truck round trip allotment.

Table S–4 provides the soil volumes that would be removed under each action alternative. As shown in Table S–4, within the accuracy of the estimates of soil volume and weight, the same quantities of soil identified as hazardous waste would be remediated under all of the action alternatives. Under the Cleanup to AOC LUT Values Alternative and the Cleanup to Revised LUT Values Alternative, all soil with radionuclide concentrations above provisional AOC LUT values would be removed and disposed of as radioactive waste. Under both scenarios of the Conservation of Natural Resources Alternative, much smaller volumes of soil would be removed that require disposal as radioactive waste. Soil would be removed so that the residual risk is within the target risk range of 1 in 10,000 to 1 in 1 million, but most of the soil that would require disposal as radioactive waste would be removed because of chemical risk or toxicity, not because of its radionuclide content. As shown in Table S–4, a large volume of non-waste soil would be removed under the Cleanup to AOC LUT Values Alternative and a lesser quantity under the Cleanup to Revised LUT Values Alternative. Based on a CERCLA risk assessment approach to site cleanup, this soil would not be removed from the site as shown for both scenarios under the Conservation of Natural Resources Alternative.

Estimated numbers of annual heavy-duty truck round trips are based on a planning level evaluation of the number of truck round trips that would occur per day. For soil remediation, heavy-duty truck round trips were assumed to average 16 per day for soil removal and delivery of backfill, although the actual number of truck trips on a given day may be higher or lower (peak daily heavy-duty truck round trips are not expected exceed 32). In addition to the routine transport of waste and backfill, there may be occasional truck trips for other purposes, such as the delivery of heavy equipment.

Costs of the alternatives correlate to the quantity of soil removed; that is, the larger the quantity of soil removed, the higher the costs. Although there would be some reduction in the residual site risk following remediation with each increment of soil removed, proceeding from the alternative with the least soil removed (Conservation of Natural Resources Alternative, Open Space Scenario) to that with the most soil removed (Cleanup to AOC LUT Values Alternative), the largest reduction in risk would occur between the No Action Alternative and the Conservation of Natural Resources Alternative,

[35] Based on an evaluation of the rate of excavation and disposal of soil (DOE 2018), DOE revised the estimated average number of truck trips per day to 16 in this Final EIS. In the Draft EIS, the number of daily truck trips was assumed to be 32 to 48 based on the number allowed according to the *Transportation Agreement for the Santa Susana Field Laboratory Ventura County, California Between the Boeing Company (Boeing) and the U.S. Government As Represented by the National Aeronautics and Space Administration (NASA) and the Department of Energy (DOE)* (Boeing 2015).

Open Space Scenario. Even though the largest increment of soil would be removed between the Cleanup to Revised LUT Values Alternative and the Cleanup to AOC LUT Values Alternative, there would be minimal change in the residual site risk associated with removal of this soil. (See the text box, Comparison of Risk Management and Cost among Soil Remediation Alternatives.)

Under all action alternatives, DOE would clean up in the areas in which the exemption process would be applied for protection of sensitive biological and cultural resources (see Figures S–6, S–7, S–8, and S–9). DOE would identify the areas that would be protected and those that would require cleanup in the soil remediation plan that would be submitted to DTSC for approval. DOE would implement these exemptions on a case-by-case basis in consultation with DTSC, only remove the quantity of soil necessary to reduce the risk, and take all precautions to protect the environment as part of the action.

Comparison of Risk Management and Cost Among Soil Remediation Alternatives

Appendix K of this EIS presents an analysis of the costs and benefits of the soil remediation alternatives. The costs are presented in terms of present worth, that is, the cost in current dollars, taking into account the duration of the alternative and the future value of money. The benefits are presented as risks to human health as measured by the residual risk of cancer or the hazard index (for non-cancer-causing chemicals) following implementation of an alternative. The analysis is based on a detailed risk assessment of 19 exposure areas and a comparative evaluation of 51 additional locations. The19 exposure areas were selected because they were identified by EPA as having radionuclide contamination, had been subject to prior cleanup actions, and provided a range of chemical constituents characteristic of Area IV operations. The range of risk in these 19 exposure areas is expected to represent the upper boundary across Area IV and the NBZ for cancer risk and for noncancer hazard. Results of these analyses as applied to Area IV and the NBZ are summarized below. As shown below, the cancer risks and toxic hazards (as indicated by the hazard index) decrease across the alternatives from the highest level (under the No Action Alternative) to the lowest level (under the Cleanup to AOC LUT Values Alternative). Conversely, the costs increase across the alternatives in reverse order, with the lowest cost under the No Action Alternative and the highest cost under the Cleanup to AOC LUT Values Alternative.

No Action Alternative

Cost:	\$3.3 million
Cancer risk:	5×10^{-6} to 2×10^{-3} or 1 chance in 500 to 200,000
Hazard index:	0.1 to 100

Conservation of Natural Resources Alternative, Open Space Scenario

Cost:	\$43 million
Cancer risk:	3×10^{-7} to 1×10^{-5} or 1 chance in 100,000 to 3,300,000
Hazard index:	0.01 to 0.3

Conservation of Natural Resources Alternative, Residential Scenario

Cost:	\$50 million
Cancer risk:	1×10^{-6} to 5×10^{-5} or 1 chance in 20,000 to 1,000,000
Hazard index:	0.1 to 1

Cleanup to Revised LUT Values Alternative

Cost:	\$230 million
Cancer risk:	5×10^{-7} to 5×10^{-5} or 1 chance in 20,000 to 2,000,000
Hazard index:	0.06 to 0.9

Cleanup to AOC LUT Values Alternative

Cost:	\$774 million
Cancer risk:	4×10^{-7} to 5×10^{-5} or 1 chance in 20,000 to 2,500,000
Hazard index:	0.05 to 0.9

Notes:

The cancer risk and hazard index for the Conservation of Natural Resource, Open Space Scenario are for an onsite recreational user. For all other alternatives/scenarios, they are for a hypothetical onsite resident.

Consistent with normal practices at this stage of project development, rough order of magnitude costs for implementing the alternatives were estimated. Actual costs would be expected to fall within a range from 20 percent less to 40 percent more than the rough order of magnitude estimate.

Table S–4 Remediation Soil Quantities and Truck Traffic by Alternative

	Cleanup to AOC LUT Values Alternative	*Cleanup to Revised LUT Values Alternative*	*Conservation of Natural Resources Alternative*	
			Residential Scenario	*Open Space Scenario*
Project Duration	26 years	6 years	About 2 years	Less than 2 years
Area Affected	90 acres	38 acres	10 acres	9 acres
1. Non-waste soil Chemicals above AOC LUT values, but below risk-based levels and hazardous waste standards. Radionuclides at or below provisional AOC LUT values.	718,000 cubic yards 1,077,000 tons 46,800 truckloads	28,000 cubic yards 42,000 tons 1,800 truckloads	a	a
2. Moderate-risk soil Chemicals above risk-based levels, but below hazardous standards. Radionuclides at or below provisional AOC LUT values.	51,000 cubic yards 76,500 tons 3,300 truckloads	50,000 cubic yards 75,000 tons 3,300 truckloads	49,000 cubic yards 73,500 tons 3,200 truckloads	36,000 cubic yards 54,000 tons 2,300 truckloads
3. Hazardous Waste Chemicals above hazardous waste standards. Radionuclides at or below provisional AOC LUT values.	2,000 cubic yards 3,000 tons 130 truckloads	2,000 cubic yards 3,000 tons 130 truckloads	2,000 cubic yards 3,000 tons 130 truckloads	2,000 cubic yards 3,300 tons 130 truckloads
4. LLW/MLLW Chemicals below or above AOC LUT values. Radionuclides above provisional AOC LUT values.	110,000 cubic yards 165,000 tons 7,200 truckloads	110,000 cubic yards 165,000 tons 7,200 truckloads	1,000 cubic yards 1,500 tons 65 truckloads	200 cubic yards 300 tons 13 truckloads
Total Volume	881,000 cubic yards	190,000 cubic yards	52,000 cubic yards	38,200 cubic yards
Total Weight	1,322,000 tons	285,000 tons	78,000 tons	57,300 tons
Total Heavy-Duty Truck Round Trips [b]	57,500 truckloads	12,400 truckloads	3,400 truckloads	2,500 truckloads

AOC = *Administrative Order on Consent for Remedial Action*; LUT = Look-Up Table.

[a] Non-waste soils are those cleaned up because they exceed chemical LUT value(s) even if they do not pose a risk. Under the Conservation of Natural Resources Alternative, soil is removed based on risk; therefore, no non-waste soil would be removed.

[b] Truck round trips were conservatively estimated based on transporting 23 tons of soil per truck. If 20-ton trucks were used for hazardous and radioactive waste, truck trips would be increased by 2 percent under the Cleanup to AOC LUT Values Alternative, 9 percent under the Cleanup to Revised LUT Values Alternative, and less than 1 percent under the Conservation of Natural Resources Alternative scenarios.

Notes:

- Sums and products may not equal those calculated from table entries due to rounding.
- Cubic yards are converted to tons using a conversion factor of 1.5 tons per cubic yard (see Appendix D).

S.10.3 Building Demolition Alternatives

S.10.3.1 Background

A total of 22 structures remain in Area IV; 18 are owned by DOE and 4 by Boeing, as shown in **Figure S–10**. In this EIS, DOE is evaluating disposition of its 18 structures in Area IV. DOE has never had buildings in the NBZ. Seven of the 18 DOE structures are metal sheds used for material storage; the other 11 are more-substantial structures, consisting of prefabricated metal buildings constructed on grade-level, concrete platforms; buildings with formed concrete basements; and buildings with cinder block/concrete walls and metal roofs. The more substantial structures are the Sodium Pump Test Facility (Buildings 4462 and 4463), ETEC Office Building (Building 4038), Building 4057, Hazardous Waste Management Facility (HWMF) (Buildings 4029 and 4133), RMHF (Buildings 4021, 4022, and 4034), and former reactor complex buildings (Buildings 4019 and 4024). The seven metal sheds are part of the RMHF (Buildings 4044, 4075, 4563, 4621, 4658, 4665, and 4688). The HWMF no longer manages hazardous waste and RMHF no longer manages radioactive waste. Five buildings operated as RCRA storage and treatment facilities are regulated by DTSC, three at RMHF (Buildings 4021, 4022, and 4621) and the two HWMF buildings (Buildings 4029 and 4133). DOE has prepared and submitted RCRA closure plans for these facilities to DTSC. Building 4057 is used for field equipment storage and Building 4034 is used as an onsite office by the operating contractor; the remaining buildings are unoccupied and unused. In addition to the structures, the associated parking lots are included as part of the building demolition activity.

Two alternatives are being evaluated for building demolition: the No Action Alternative and the Building Removal Alternative.

S.10.3.2 Building No Action Alternative

Under the Building No Action Alternative, the 18 DOE-owned structures in Area IV would remain in place. DOE would conduct surveillance and maintenance as needed for safety (e.g., preventing access). Because radiological materials would remain in some buildings, DOE would continue its responsibilities in accordance with the Atomic Energy Act and ensure continuation of security that restricts access to Area IV and the structures.

S.10.3.3 Building Removal Alternative

Under this alternative, DOE would demolish the 18 structures it owns in Area IV and dispose of or recycle the materials off site. The aboveground and belowground structures would be demolished and the entirety of demolition debris would be completely removed from the site. Demolition of buildings other than those regulated by DTSC may start following the issuance of a DOE ROD for this EIS. Demolition of the DTSC-regulated buildings would additionally depend on a decision following completion of the DTSC program environmental impact report (EIR) prepared under the California Environmental Quality Act (CEQA)[36] and approval of RCRA closure plans. Assuming necessary documents are completed and approvals received such that building demolition can proceed uninterrupted, it would take between 2 to 3 years to complete, contingent on funding. Building removal activities are estimated to disturb about 8.4 acres. Approximately 1,500 truck round trips would be required to haul the DOE building demolition debris from Area IV for either disposal or recycle.

[36] DTSC is preparing a program EIR for the entire SSFL (Areas I through IV, the NBZ, and the Southern Buffer Zone). The program EIR evaluates remediation activities of DOE, NASA, and Boeing. The *Draft Program Environmental Impact Report for the Santa Susana Field Laboratory, Ventura County, California* (*Draft Program EIR*) was issued in September 2017 (DTSC 2017).

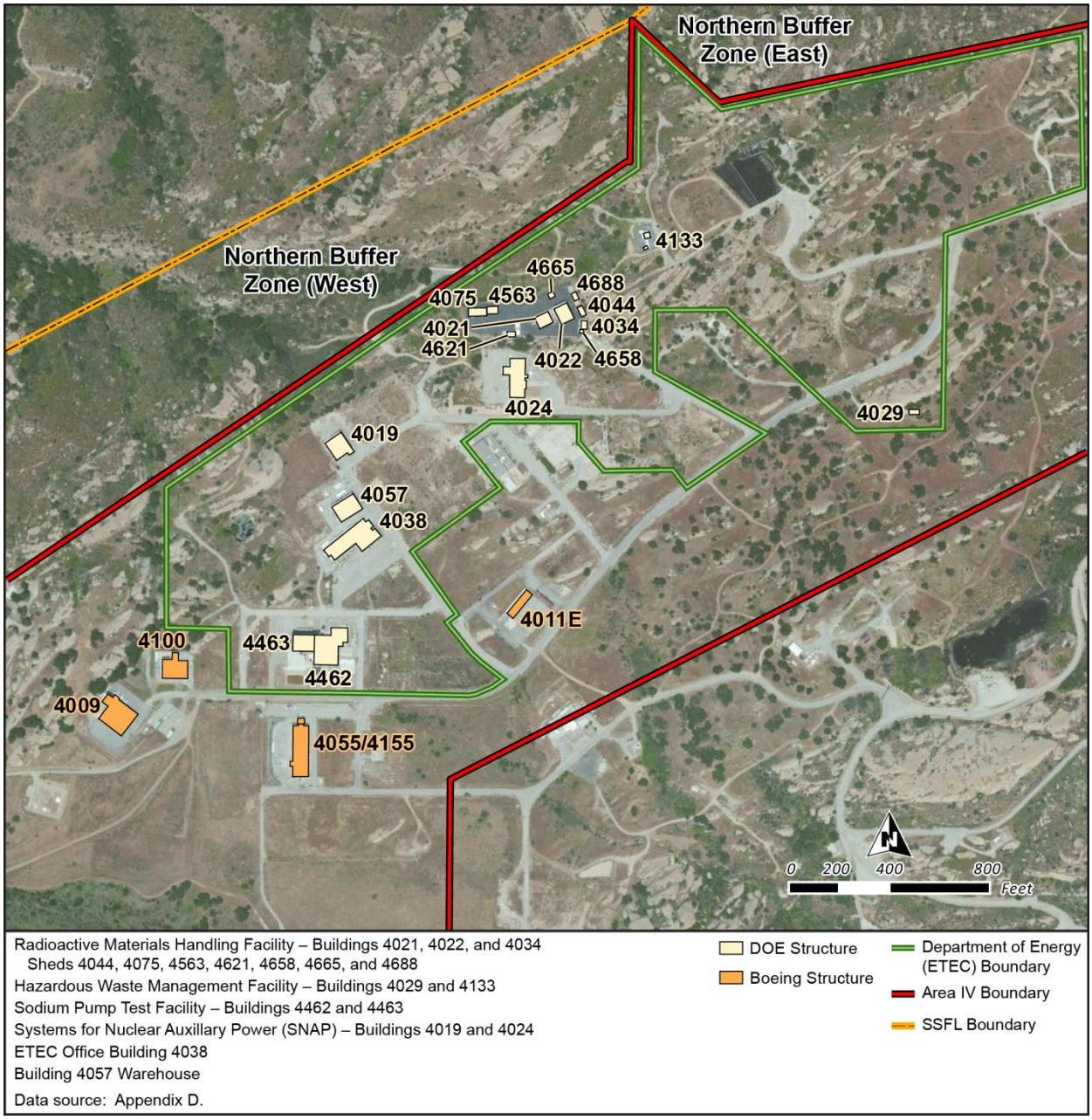

Figure S–10 Remaining Structures in Area IV

Building demolition plans would be prepared by DOE's demolition contractor to ensure worker safety is maintained throughout the demolition process and regulatory requirements and DOE guidelines are met. These plans would include identifying potential hazards (such as active electrical service, the presence of radiological or chemical materials, or building structural issues) and specifying protective equipment and procedures to protect workers from specific hazards.

At least two staging areas would be established to support building demolition and soil remediation work. The first would be the main staging area within the north-central portion of Area IV, near Building 4024. This staging area may be supplemented by an additional area south of Building 4038 (see Figure S–10) that would include a contractor trailer, worker parking, portable restrooms, heavy equipment parking, and a decontamination pad. As necessary, temporary RCRA storage areas would be established to store wastes while awaiting shipment off site for disposal. The storage areas would

consist of areas approximately 20 feet square, with berms around the perimeter and liners to capture any potential spills.

In preparation for demolition activities, surveys of building structural materials for the presence of radioactivity would be conducted. Waste from the buildings within RMHF and Building 4024 would be managed and disposed of off site as radioactive waste. In this EIS, waste from other buildings that have a radioactive history was also assumed to be disposed of as radioactive.[37] During project implementation, process knowledge, radiological surveys, and waste characterization would be performed and waste would be managed and disposed of in accordance with their actual characteristics, DOE Orders, regulations, and disposal or recycle facility acceptance criteria. Building materials that do not have a radioactive history, have been determined to be free of radioactive contamination, and do not contain hazardous materials would be transported to a recycle facility to the extent possible or a permitted waste disposal facility. Materials from buildings that cannot be shown to be suitable for free release[38] would be managed as radioactive waste and would be transported to a Federal or commercial radioactive waste disposal facility.[39] Building materials from structures associated with hazardous waste management or chemical usage permits would be transported to a permitted California Class I or out-of-state hazardous waste disposal facility.

Table S–5 shows the estimated quantities of building demolition waste and debris that would be disposed of or recycled by type. A larger quantity of radioactive waste than other types of waste is identified because materials from buildings with a radiological history would be managed as radioactive waste for disposal purposes unless they can be demonstrated to be suitable for free release.

DOE may decide to accelerate the schedule and shorten the duration of the building demolition activities. For purposes of evaluating the potential impacts of an accelerated schedule, in this EIS it is assumed that the project would be completed in about half the time (about 1 year) by doubling the actions necessary to accomplish demolition and waste disposal (e.g., 2 work crews, twice the number of waste shipments). Appendix L, Sensitivity Evaluations, includes an assessment of the change in environmental effects that an accelerated building removal would cause relative to the base case of the Building Removal Alternative.

Following removal of the slabs and subgrade structures, radiological surveys of building footprints would be conducted. Soil sampling for chemicals and radionuclides would be conducted in accordance with DTSC-approved plans. Any soil encountered above the soil remediation level selected for implementation would be remediated or removed and disposed of during the soil remediation effort. Soil would be replaced to the extent necessary to ensure safe working conditions. Dust and erosion control measures, such as spraying with water, surfactants, or a soil binder and/or covering exposed soil with mulch or straw wattles, would be used to minimize dust and erosion issues until the area is recontoured and revegetated.

[37] Waste from all buildings with a radioactive history is assumed to be disposed of as radioactive waste. Waste only from Buildings 4038, 4057, 4462, and 4463 is not assumed to be radioactive.

[38] Materials are suitable for free release if they do not exhibit radioactivity above background levels.

[39] See Appendix D, Section D.4 for a discussion of the sites that were considered reasonable disposal locations for the different waste types and those that were selected as representative and analyzed in detail in this EIS. Representative LLW and MLLW disposal facilities evaluated in this EIS include DOE's Nevada National Security Site and the commercial facilities Energy*Solutions* in Utah, and Waste Control Specialists, in Texas.

Table S–5 Estimated DOE Area IV Building Demolition Materials

Type	*Volume (cubic yards)* [a]
From Buildings with a Radioactive History [b]	
Low-level radioactive waste	3,280
Mixed low-level radioactive waste	18
Debris [c]	7,220
Hazardous debris [c, d]	130
From Buildings with No Radioactive History [b]	
Hazardous waste	120
Recyclable steel, concrete, and asphalt	3,540
Nonhazardous debris	1,220

[a] Volumes estimated from North Wind 2014. Demolition materials would be transported offsite in approximately 1,500 heavy-duty truck loads.

[b] For purposes of estimating waste volumes, buildings with no radioactive history include 4038, 4057, 4462, and 4463; all other building were considered to have a radioactive history.

[c] Materials from buildings with a radiological history would be managed as radioactive waste for disposal purposes unless they can be demonstrated to be suitable for free release. To be determined to be free-released debris or free-released hazardous debris, material would not exhibit radioactivity above background levels.

[d] Includes waste materials regulated under statutes other than the Resource Conservation and Recovery Act (e.g., the Toxic Substances Control Act).

S.10.4 Groundwater Remediation Alternatives

S.10.4.1 Background

Investigation of bedrock groundwater in Area IV was initiated in 1986 with the installation of a well at the Building 56 landfill site. Since then, additional deep bedrock wells have been installed throughout Area IV (two wells were deemed no longer necessary when Building 4059 was removed). Investigation of the near-surface groundwater at SSFL was initiated in March 2001. As part of the investigation of near-surface groundwater, DOE has installed wells to depths of less than 100 feet (one of which has since been closed and sealed). As of May 2018, the Area IV groundwater monitoring well network consisted of 124 wells, 66 deep bedrock wells and 58 shallow wells, with additional wells planned. Approximately 40 wells are sampled each year.[40]

Figure S–11 illustrates six primary areas of groundwater requiring cleanup within Area IV:

- a trichloroethylene (TCE) plume associated with the Former Sodium Disposal Facility (FSDF),
- a TCE plume associated with the Building 4100/56 landfill,
- a perchloroethylene (PCE) plume near Building 4057,
- a TCE plume associated with the Hazardous Materials Storage Area (HMSA),
- a tritium plume (associated with the former Building 4010 area), and
- a strontium-90 source associated with the RMHF leach field.

[40] The wells to be sampled and the analyses to be performed are described in the *Site-Wide Water Quality Sampling and Analysis Plan, Revision 1, Santa Susana Field Laboratory, Ventura County, California* (Haley and Aldrich 2010).

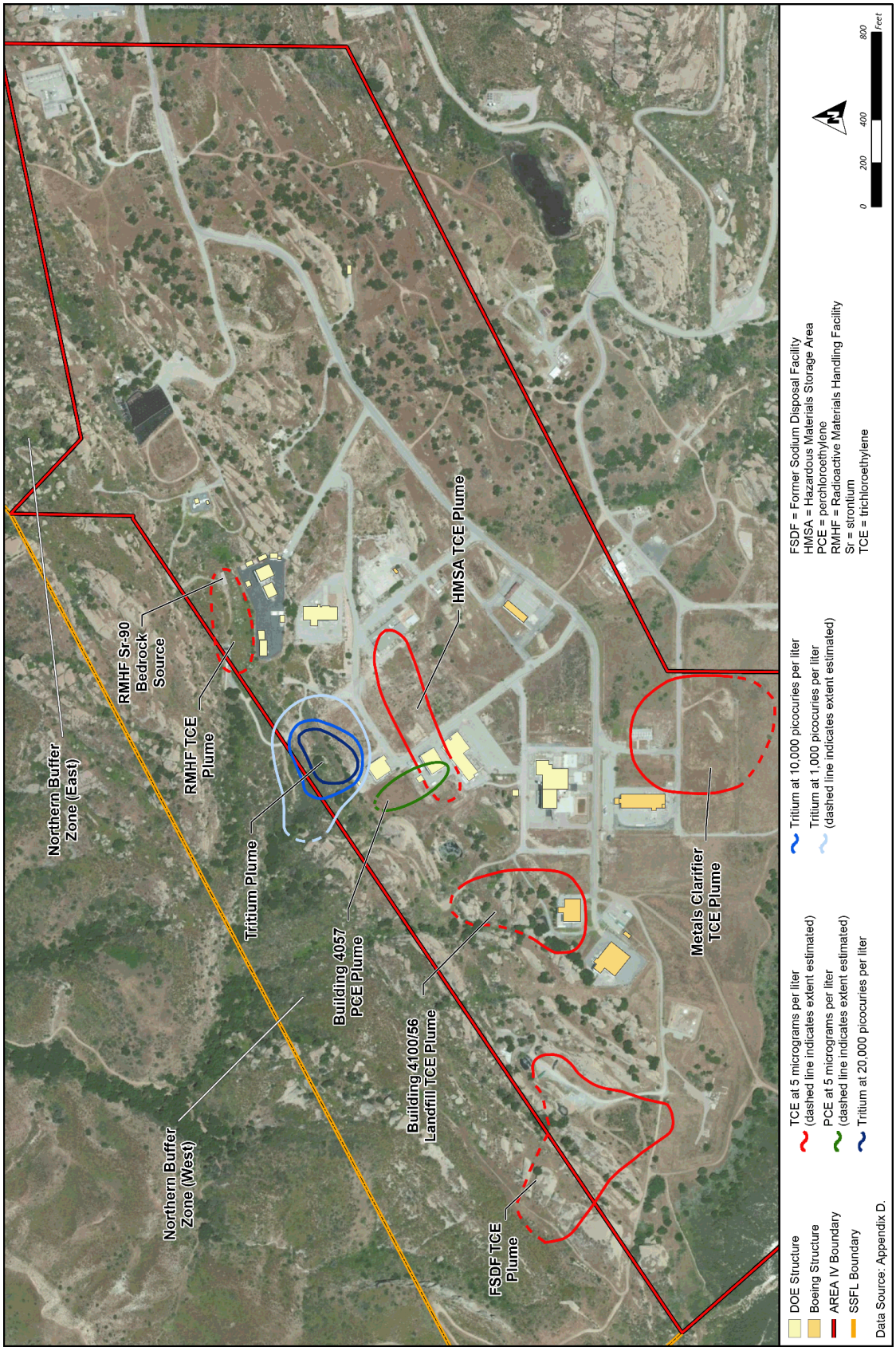

Figure S–11 Area IV Groundwater Plumes

Additionally, there are two other areas with lower concentrations of groundwater contamination, mainly solvents, which are being evaluated: the RMHF TCE plume and the Metals Clarifier TCE plume.

The 2010 AOC (DTSC 2010a) incorporated by reference the requirements for investigation and cleanup of groundwater contained in the 2007 CO (DTSC 2007). The 2007 CO directs cleanup to be completed in accordance with RCRA requirements. Groundwater characterization requirements were evaluated during development of the RCRA Facility Investigation Work Plan (CDM Smith 2015a). A *Draft RCRA Facility Groundwater Remedial Investigation Report, Area IV* (Draft Remedial Investigation Report) (CDM Smith 2018a) was prepared that synthesizes historic and current groundwater characterization data and defines the locations and extent of groundwater contamination for which DOE is responsible. A *Draft Groundwater Corrective Measures Study, Area IV* (Draft Corrective Measures Study) (CDM Smith 2018b) has been developed concurrently with this EIS to identify, evaluate, and select groundwater treatment technologies (e.g., pumping and treatment [commonly called pump and treat], soil vapor extraction, monitored natural attenuation) to be applied as remedial actions. Both the Draft Remedial Investigation Report and Draft Corrective Measures Study have been submitted to DTSC. In support of the Corrective Measures Study, DOE collected hydrogeologic data that will allow modeling of the transport and fate of groundwater contamination and support remedy selection. All groundwater remedies would involve monitoring to confirm modeling assumptions and assess remedy effectiveness.

Potential environmental impacts of implementing the groundwater treatment technologies are evaluated in this EIS. DOE may select any or all of these technologies for action depending on the contaminant, source, and location of the impacted groundwater. This Final EIS evaluates the potential impacts that could occur during groundwater remediation activities identified in the Draft Corrective Measures Study, assuming implementation of the appropriate groundwater remediation technologies that would result in the largest potential impacts. Descriptions of possible groundwater actions are described in the following paragraphs.

S.10.4.2 Groundwater No Action Alternative

Under the Groundwater No Action Alternative, current groundwater monitoring would continue in accordance with the requirements of the 2007 CO. This includes visiting all wells to check water levels and sampling selected wells. Because this is the No Action Alternative, it was assumed that DOE would not implement additional monitoring or actions other than those to which they have previously committed. As part of the SSFL-wide groundwater interim measures, DOE would continue to implement the FSDF Groundwater Interim Measure that was initiated in November 2017 to extract TCE-contaminated groundwater.[41] Over time, concentrations of radiological and chemical constituents would be reduced through natural attenuation (decay, degradation, dispersion, and dilution).

[41] A *Draft Santa Susana Field Laboratory Former Sodium Disposal Facility Groundwater Interim Measures Implementation Plan* (CDM Smith 2015c) was developed for constructing and operating a groundwater treatment system at the FSDF for removal of TCE. In recent years, water levels at the FSDF have been low because of less than average rainfall and the TCE concentration has dropped. The winter of 2016-2017 produced sufficient rainfall to saturate near-surface fractures harboring TCE. DOE began pumping groundwater from FSDF well RS-54 in November 2017. The well was repeatedly pumped dry in about 20 minutes, allowed to recover (i.e., refill with water), then pumped again. The well failed to recover in March 2018 and pumping was stopped. DOE continues to check water levels at the FSDF and pump it when enough water has accumulated. By June 2018, a total of 330 gallons of groundwater had been removed (CDM Smith 2018c).

S.10.4.3 Groundwater Monitored Natural Attenuation Alternative

Natural attenuation is the use of natural processes that reduce the concentration of constituents over time. Mechanisms include biodegradation, which is the degradation of contamination resulting from naturally occurring microbes, as well as physical processes such as volatilization, dispersion, dilution, and radioactive decay. Under favorable geochemical and microbial conditions, chlorinated solvents like TCE and PCE have been shown to break down; that is, in chemically reducing environments and in the presence of certain naturally occurring microbes; concentrations of these chemicals would be reduced through biodegradation.

Monitored natural attenuation requires demonstration that the natural processes are in place and working prior to its selection as a remediation technology. It also requires that monitoring be conducted throughout the period of remediation to confirm that the natural processes are continuing to be effective. Monitored natural attenuation would only be considered as a groundwater remedy for locations where a source to groundwater no longer exists or has been reduced through an active remedy as explained in the bullets below.

Under this alternative, no active remediation of any DOE groundwater plumes would occur. In addition to the wells that would continue to be monitored under the No Action Alternative, DOE would propose to DTSC the installation and monitoring of additional wells. The plumes would be sampled (i.e., monitored) on an established schedule to confirm that reduction of the contaminant concentrations continues as anticipated. Monitoring periods would be based on the expected radionuclide decay or natural chemical decomposition over time. Most monitoring would be completed in 10 to 50 years; however, monitoring of strontium-90 contamination at the RMHF leach field would last about 150 years. Monitoring time frames would be adjusted, based on sampling results. The DOE groundwater plumes, the contaminants and their concentration, and the expected monitoring are listed below (CDM Smith 2018a):

- For the FSDF TCE plume, TCE and 1,1,1-trichloroethane are currently above 1,000 parts per billion, and there are low levels (below the maximum contaminant levels [MCLs]) of perchlorate present (CDM Smith 2018a). Monitored natural attenuation would not be considered until concentrations were reduced to less than 50 parts per billion through active remediation. The remaining TCE would be monitored until it reached the MCL of 5 parts per billion.
- For the HMSA perched groundwater plume with TCE at 200 parts per billion (North Wind 2018), monitored natural attenuation would be implemented after pump and treat reduced the volatile organic compound mass and reduced concentrations. Monitored natural attenuation would then be performed until it reached the MCL of 5 parts per billion.
- For the Building 4100/4056 landfill TCE plume, TCE is currently approximately 48 parts per billion (CDM Smith 2015a). Monitored natural attenuation would be implemented after active treatment through pump and treat and would be performed until the PCE concentration reached the MCL of 5 parts per billion.
- For the Building 4057 PCE plume (currently at 48 parts per billion) (CDM Smith 2018a), monitored natural attenuation would be implemented after about 3 years of active treatment through pump and treat. Monitored natural attenuation would then be performed until the PCE concentration reached the MCL of 5 parts per billion.

- For the Metals Clarifier TCE plume (currently at 11 parts per billion) (North Wind 2018), monitoring would be performed until the concentration reached the MCL of 5 parts per billion.
- For the RMHF leach field, both strontium-90 and TCE would be monitored. Strontium-90 has a 28.8-year half-life (the period of time required for half of the strontium-90 to decay to a nonradioactive isotope). With an MCL of 8 picocuries per liter and maximum activity concentrations of 183 picocuries per liter in 2010 29.5 picocuries per liter in 2015, and 65.8 picocuries per liter in 2018, monitoring would need to continue for about 150 years. For the TCE plume (currently 2.1 to 11 parts per billion [CDM Smith 2018a]), monitoring would continue until the 5 parts per billion MCL is reached. The time frame for monitoring is uncertain because TCE in this plume has been relatively constant for about 15 years. This constant concentration is consistent with the conceptual model that assumes that TCE in the bedrock fractures has been removed and the current source is slow, continuous diffusion of TCE from the bedrock matrix.
- For the tritium plume, data indicate that radioactive decay would reduce tritium (with a 12.3-year half-life) to its 20,000 picocuries per liter drinking water MCL by 2025 (CDM Smith 2018a). Tritium in the plume was measured at 31,600 picocuries per liter in the first quarter of 2018 (North Wind 2018).

S.10.4.4 Groundwater Treatment Alternative

Under the Groundwater Treatment Alternative, DOE would identify the treatment technology to be applied to each plume or source area in a final would be selected following the completion of a RCRA Corrective Measures Study to be submitted to DTSC for approval. Treatment technologies being considered for each plume or source area are based on an assessment included in the *Draft RCRA Facility Groundwater Remedial Investigation Report, Area IV* (CDM Smith 2018a). **Table S–6** shows the treatment technologies that DOE deems most appropriate for each of the groundwater plumes and the strontium-90 source.

Table S–6 Potential Application of Groundwater Treatment Technologies

	Treatment Technology				
Plume or Source	***Pump and Treat***	***Bedrock Vapor Extraction***	***Source Isolation***	***Source Removal***	***Monitored Natural Attenuation***
FSDF TCE plume	✓	✓			✓
Building 4100/56 TCE plume	✓	✓			✓
Building 4057 PCE plume	✓	✓			✓
Tritium plume					✓
HMSA TCE plume	✓	✓			✓
RMHF strontium-90 source			✓	✓	
Metals Clarifier TCE plume					✓
RMHF TCE plume					✓

FSDF = Former Sodium Disposal Facility; HMSA = Hazardous Materials Storage Area; PCE = perchloroethylene; RMHF = Radioactive Materials Handling Facility; TCE = trichloroethylene.

[a] The Metals Clarifier and RMHF TCE plume concentrations are in the 10 to 15 parts per million range and would not be amenable to treatment.

[b] The tritium plume would meet its MCL by 2025 through radioactive decay so is not addressed by any active treatment.

The following treatment methods are being considered for groundwater remediation. Technologies include those deemed most appropriate for each plume (as identified in Table S–6, as well as other technologies identified in the Draft Corrective Measures Study.

The plumes with chlorinated solvents (e.g., FSDF, HMSA, Building 4100/56 landfill, and Building 4057) could be treated using one or a combination of methods including pump and treat, followed by local re-injection of treated water; enhanced groundwater treatment, consisting of *in situ* treatment such as chemical injection or biological enhancement; or bedrock vapor extraction. The HMSA perched groundwater plume could also be treated by dewatering (i.e., removing the perched plume by pumping).

The RMHF leach field strontium-90 source could be remediated by removing the bedrock that is contaminated with strontium-90 (source removal), source isolation, or lowering the groundwater table by through active pumping.

The Metals Clarifier TCE plume and the RMHF TCE plume concentrations are in the range 10 to 15 parts per million and would not be amenable to treatment. Because the tritium plume would meet its MCL by 2025 through radioactive decay, it would not be addressed by any active treatment. Remediation of these plumes would be accomplished by monitored natural attenuation, as under the Monitored Natural Attenuation Alternative.

S.10.5 Preferred Alternative[42]

DOE's preferred alternative for soils remediation is the Conservation of Natural Resources, Open Space Scenario. DOE is identifying this as the preferred alternative because it would be consistent with the risk assessment approach typically used at other DOE sites, other DTSC-regulated sites, and EPA CERCLA sites, which accounts for the specific future land use of the site. Use of a risk assessment approach would be consistent with the process being used by Boeing for the land it owns at SSFL and recognizes the Grant Deeds of Conservation Easement and Agreements (Ventura County 2017a, 2017b) that commit Boeing's SSFL property, including Area IV and the NBZ, to remaining as open space. This scenario would use a CERCLA risk assessment approach that would be protective of human health and the environment rather than LUT values (action levels). The 2010 AOC allows DOE and DTSC to agree upon changes to the AOC to better meet cleanup objectives. DOE expects to engage DTSC in discussions about such changes in order to implement this soil remediation alternative.

For building demolition, DOE's preferred alternative is the Building Removal Alternative. Under this alternative DOE would demolish the 18 DOE-owned buildings in Area IV and transport the resulting waste off site for disposal. Demolition of thirteen facilities and disposition of the resulting debris would be in accordance with DOE requirements and applicable laws and regulations. Three facilities at the RMHF and the two facilities comprising the HWMF would be closed in accordance with DTSC-approved RCRA facility closure plans.

[42] This section identifies DOE's preferred alternative at the time of publication of this Final EIS but does not predetermine DOE's decision, which will be announced in one or more RODs.

DOE's preferred alternative for groundwater remediation is a combination of the Treatment Alternative and the Monitored Natural Attenuation Alternative. DOE would treat the groundwater plumes with higher concentrations of contaminants (the FSDF, HMSA, Building 4100/56, and Building 4057 plumes) in accordance with the results of the final Corrective Measures Study. Source removal is the preferred alternative for the strontium-90 source. Monitored natural attenuation would be used for plumes that are not amenable to active treatment – the two plumes with the lowest concentrations of TCE (the Metals Clarifier and RMHF plumes) and the tritium plume. DOE's proposed groundwater remedial actions would be included in the final Corrective Measures Study submitted to DTSC for approval.

S.11 Summary of Potential Environmental Consequences

S.11.1 Comparison of Potential Environmental Consequences of Alternatives

This section summarizes the consequence analyses for the alternatives evaluated in this EIS. The summaries are provided in table format for each component of the Area IV and NBZ cleanup. **Table S–7** provides the summary of consequences for the soil remediation alternatives, **Table S–8** for the building demolition alternatives, and **Table S–9** for the groundwater remediation alternatives.

This summary tables present potential human health impacts associated with exposure to chemical and radiological constituents. Potential impacts associated with exposure to chemicals or radiological constituents can be reported as morbidity (cancer incidence) or mortality (a latent cancer fatality [LCF]). In the field of site remediation and restoration, the EPA has established risk thresholds and ranges that are used to evaluate whether a remedial action is necessary and if so, how much of a contaminant must be removed from a site to render it acceptable for its intended use. The values established by EPA are for incidence of cancer. Therefore, except as noted below, reference to cancer risk in these tables means the risk of cancer incidence, that is, the risk of developing a cancer. Thus, the potential cancer risk impacts on an onsite or offsite resident or recreational user presented in this EIS are the risk of developing a cancer.

The exception to presenting cancer risks as the incidence of cancer occurs for reporting potential radiological impacts from transporting radioactive material. Health impacts from transporting radioactive materials have been presented as LCFs by DOE and the Nuclear Regulatory Commission for decades. This EIS maintains this reporting protocol, which allows comparison to other transportation risks (fatalities from traffic accidents) and, in the cumulative impacts analysis, comparison with the reported radiological risks from other radioactive material transport actions.

Table S–7 Summary of Potential Environmental Consequences under the Soil Remediation Alternatives

	Alternatives			
Resource Area	***Soil No Action***	***Cleanup to AOC LUT Values***	***Cleanup to Revised LUT Values***	***Conservation of Natural Resources (Residential and Open Space Scenarios)***
Land resources	- Land use for Area IV and the NBZ would be consistent Ventura County's general plan designation and zoning, and with the landowner's (Boeing's) two Grant Deeds of Conservation Easement and Agreement with the North American Land Trust that permanently preserves most of SSFL as open space and prohibits the use of the site for agricultural or residential development (Ventura County 2017a, 2017b).No impacts are expected on use of Sage Ranch Park or other recreation areas in the SSFL vicinity. - Electricity and water use would be minimal. - No change in aesthetics and visual quality from baseline conditions.	- Land use during and after remediation would be consistent with Ventura County's general plan designation and zoning, and with Boeing's two Grant Deeds of Conservation Easement and Agreement with the North American Land Trust that permanently preserves most of SSFL as open space and prohibits the use of the site for agricultural or residential development (Ventura County 2017a, 2017b). - During 26 years of soil removal, the average daily traffic on Woolsey Canyon Road would increase by up to 3.3 percent, which could discourage weekday use of Sage Ranch Park. Traffic on evaluated roads other than Woolsey Canyon Road is expected to increase by no more than 1.5 percent, with no expected impacts on use of other recreation areas in the SSFL vicinity. - Electricity use would be minimal. Annual water use would be about 1.75 million gallons; total water use would be about 46 million gallons. Annual use would represent about 0.004 percent of CMWD's annual supply. Water use is an important consideration because of California's drought conditions and California's 2018 legislation targeting reductions in water use statewide (State of California 2018). - There would be onsite impacts on aesthetics and visual quality during the 26 years of soil removal, but long-term improvements to aesthetics and visual quality resulting from returning Area IV to a stabilized, revegetated state. The terrain would retain the appearance of an open space crossed by roads.	- Land use would be the same as that under the Cleanup to AOC LUT Values Alternative. - Impacts on recreation areas would be similar to those under the Cleanup to AOC LUT Values Alternative, except that increased traffic would last for 6 years. - Electricity use would be minimal. Annual impacts on water would be the same as those under the Cleanup to AOC LUT Values Alternative; total water use would be about 11 million gallons. Water use is an important consideration for the same reasons as those under the Cleanup to AOC LUT Values Alternative. - Impacts on aesthetics and visual quality would be similar to those under the Cleanup to AOC LUT Values Alternative, but the impact duration would be less because soil removal would last for 6 rather than 26 years.	- Land use would be the same for both scenarios as that under the Cleanup to AOC LUT Values Alternative. - Impacts on recreation areas would be similar to those under the Cleanup to AOC LUT Values Alternative, except that increased traffic would last for 2 years or less. - Electricity use would be minimal. Annual impacts on water would be the same as those under the Cleanup to AOC LUT Values Alternative; total water use would be about 3.5 million gallons. Water use is an important consideration for the same reasons as those under the Cleanup to AOC LUT Values Alternative. - Impacts on aesthetics and visual quality would be similar to those under the Cleanup to AOC LUT Values Alternative, but the impact duration would be less because soil removal would last for 2 rather than 26 years.

Resource Area	Alternatives			
	Soil No Action	***Cleanup to AOC LUT Values***	***Cleanup to Revised LUT Values***	***Conservation of Natural Resources (Residential and Open Space Scenarios)***
Geology and soils	- No impacts are expected on geologic (bedrock) and paleontological resources (i.e., loss of fossils) or onsite soil function. - No activities would take place in zones where earthquake-induced landslides could occur. - Minimal soil erosion is expected from site maintenance activities, and there would be no need for backfill obtained from offsite sources.	- No adverse impacts are expected on geologic (bedrock) resources. - Potential impacts on paleontological resources (i.e., loss of fossils) would be minimal because the Santa Susana Formation containing these resources is largely located within the proposed exemption areas.[a] - Some activities in the NBZ could take place in zones where earthquake-induced landslides could occur, leading to worker risks. However, because the total area in the NBZ to be potentially remediated is only about 0.6 acres, the potential risks to workers would be small. Some locations on the southern edge of Area IV are also within zones where earthquake-induced landslides could occur, but are also generally within the proposed exemption areas, where remediation activities would be reduced and worker presence restricted. Nonetheless, DOE would minimize as needed using the 2010 AOC (DTSC 2010a) exemption process. No work would take place in areas of seismic landslide risk unless concentrations in soil present a risk to human health or the environment. - Soil erosion is possible because of the disturbance of about 90 acres of land, but would be minimized using BMPs, as summarized in Chapter 6. In the periods before completion of stabilization activities, precipitation runoff may erode soil, leading to a reduction of soil quality and functional capability within eroded areas. - About 6611,000 cubic yards of backfill would be required, with chemical and radioactive constituents in concentrations meeting AOC LUT values. Loss of soil function is possible if the backfill is not of equal soil quality (including regenerative structures, organic carbon, seed bank, and beneficial soil organisms) as that of current soil at Area IV and the NBZ.	- Impacts on geologic resources would be the same as those under the Cleanup to AOC LUT Values Alternative. - Potential impacts on paleontological resources would be minimal because the Santa Susana Formation containing these resources is largely located within areas that would be subject to the exemption process. Outside of the areas that would be subject to the exemption process, the potential for impacts on paleontological resources would be less than that for Cleanup to AOC LUT Values Alternative. - Potential impacts associated with earthquake-induced landslides and management of worker risks would be similar to those under the Cleanup to AOC LUT Values Alternative, with reduced risk to workers due to the lesser potential for work within these zones. - Potential soil erosion impacts would be reduced compared to those under the Cleanup to AOC LUT Values Alternative because less acreage would be disturbed (about 38 acres). - About 143,000 cubic yards of backfill would be required, with concentrations of chemicals meeting revised LUT values and radionuclides meeting AOC LUT values. The Area IV-wide potential for loss of soil function would be reduced compared to that under the Cleanup to AOC LUT Values Alternative.	The impacts under the Residential and Open Space Scenarios and are as follows: - Impacts on bedrock geologic resources would be the same as those under the Cleanup to AOC LUT Values Alternative for both the Residential and Open Space Scenarios. - Potential impacts on paleontological resources would be similar to those under the Cleanup to AOC LUT Values Alternative, except less than 0.1 acre of land overlying the Santa Susana Formation (and not within the proposed exemption area) would be remediated. - Potential impacts associated with earthquake-induced landslides and management of worker risks would be similar to those under the Cleanup to Revised LUT Values Alternative, but with much reduced risk to workers because of the little potential for work within these zones. - Potential soil erosion impacts would be reduced compared to those under the Cleanup to Revised LUT Values Alternative because less acreage would be disturbed. Under the Residential Scenario about 10 acres would be disturbed and under the Open Space Scenario about 9 acres would be disturbed. - The Area IV-wide potential for loss of soil function would be reduced under both the Residential and Open Space Scenarios compared to under the Cleanup to Revised LUT Values Alternative. About 39,000 cubic yards of backfill with concentrations of chemicals and radionuclides meeting risk-assessment-based values would be required under the Residential Scenario and about 29,000 cubic yards of backfill of this quality would be requires under the Open Space Scenario.

	Alternatives			
Resource Area	***Soil No Action***	***Cleanup to AOC LUT Values***	***Cleanup to Revised LUT Values***	***Conservation of Natural Resources (Residential and Open Space Scenarios)***
Surface water resources	No changes would occur to the onsite NPDES stormwater control and outfall monitoring system. Radioactive and chemical constituents would remain in soil, representing a source of potential surface water contamination if an unusually large rainstorm were to occur that exceeds the design of the NPDES system.	No adverse short-term impacts on surface water quality and runoff quantity and velocity are normally expected. During soil remediation, 90 acres would be disturbed. If an unusually large rainstorm were to occur, the design capacity of the existing onsite NPDES stormwater control and outfall monitoring system could be exceeded, resulting in offsite transport of soil and possible overwhelming of regional stormwater control capacity. However, the measures to minimize impacts, as summarized in Chapter 6, would likely forestall this risk. There would be a long-term reduction of potential sources of surface water contamination.	Same as under the Cleanup to AOC LUT Values Alternative, except the potential for impacts would be much less because much less acreage (38 acres) would be disturbed.	The impacts would be the same under both the Residential and Open Space Scenarios and are as follows: Same as under the Cleanup to Revised LUT Values Alternative, except the potential for impacts would be less because less acreage (10 acres for the Residential Scenario and 9 acres for the Open Space Scenario) would be disturbed.
Groundwater resources	A source of potential groundwater contamination would remain. There would be no requirement to withdraw site groundwater.	No adverse impacts are expected; potential positive impacts would result from removal of a potential source of groundwater contamination. There would be no requirement to withdraw site groundwater.	Same as under the Cleanup to AOC LUT Values Alternative.	The impacts under both the Residential and Open Space Scenarios are the same as under the Cleanup to AOC LUT Values Alternative.
Biological resources	No adverse impacts on vegetation and wildlife habitat and biota; aquatic and wetland habitats and biota; and threatened, endangered, or rare species are expected.	- Removal of existing vegetation and topsoil from about 90 acres would increase the difficulty of re-establishing native plant species and would reduce or eliminate the value of habitat for most wildlife species until the vegetation has reestablished. Remediation would require prolonged focused efforts to restore native vegetation and wildlife habitat. If backfill is substantially different from the original topsoil, it may not support re-establishment of native vegetation. About 33 acres of relatively undisturbed native habitat (including coast live oak woodland, northern mixed chaparral, and Venturan coastal scrub) would be affected. There would be fewer impacts within the areas where the exemption process would be applied because remediation within these areas would occur via focused removal actions that would minimize soil and habitat disturbance. - Approximately 0.34 acres of wetlands, ephemeral drainages, and drainage ditches in upland habitats would be directly	- Impacts on vegetation and wildlife habitat and biota would be reduced because the remediated acreage (38 acres) would be less than that under the Cleanup to AOC LUT Values Alternative. The smaller area affected by remediation would increase the feasibility of restoration, and there would be more undisturbed habitat between remediated portions of the site, facilitating recolonization by native plant and wildlife species and beneficial soil organisms. About 14 acres of relatively undisturbed native habitat (including coast live oak woodland and northern mixed chaparral) would be affected by remediation activities outside the proposed exemption areas. Impacts within the areas where the exemption process would be applied would total about 4 acres as described under the Cleanup to AOC LUT Values Alternative.	- Impacts on vegetation and wildlife habitat and biota would be reduced because the remediated acreage (10 acres for Residential Scenario or 9 acres for Open Space Scenario) would be considerably less than the 90 acres affected under the Cleanup to AOC LUT Values Alternative. Impacts would also be less than those under the Cleanup to Revised LUT Values Alternative (9 or 10 acres vs. 38 acres). The much smaller area affected by remediation would increase the feasibility of restoration, and there would be more undisturbed habitat between remediated portions of the site, facilitating recolonization by native plant and wildlife species and beneficial soil organisms. About 5 acres of relatively undisturbed native habitat (including coast live oak woodland and northern mixed chaparral) would be affected by remediation activities Impacts within the areas where the exemption process would be applied would total an estimated 4 acres as described under the Cleanup to AOC LUT Values Alternative. - Impacts on aquatic and wetland habitats and biota would be similar to those described under the Cleanup to AOC LUT Values Alternative, but a smaller area of ephemeral drainages would be directly affected than either of the preceding alternatives (less than 0.06 acres for both scenarios).

Resource Area	Alternatives			
	Soil No Action	***Cleanup to AOC LUT Values***	***Cleanup to Revised LUT Values***	***Conservation of Natural Resources (Residential and Open Space Scenarios)***
		affected. Potential indirect impacts on aquatic and wetland habitats and associated biota, including jurisdictional waters of the U.S., from erosion and movement of sediment or soil would be minimized by use of BMPs and mitigation measures. - Within the areas where the exemption process would be applied and where most threatened, endangered, or rare species in Area IV and the NBZ are located, as well as critical habitat for two federally listed species, impacts would be minimized through use of focused removal actions and the total area directly affected by soils removal is estimated to be 4 acres.	- Impacts on aquatic and wetland habitats and biota would be similar to those described under the Cleanup to AOC LUT Values Alternative, but a smaller area of ephemeral drainages would be directly affected. - Impacts on threatened, endangered, or rare species and critical habitat would be similar to those described under the Cleanup to AOC LUT Values Alternative	- Impacts on threatened, endangered, or rare species and critical habitat would be similar to those described under the Cleanup to AOC LUT Table Values Alternative.
Air Quality and climate	No emissions of pollutants, including CO_2, above baseline conditions are expected.	Pollutants such as VOCs, CO, NOx, SO_2, and particulates would be emitted from onsite activities, with nearly all particulate emissions arising from fugitive dust. Additional emissions would occur from on-road vehicles. A total of 30,000 to 80,000 metric tons of CO_2 would be emitted, primarily from vehicles.	The same types of pollutants would be emitted as those under the Cleanup to AOC LUT Values Alternative, but in smaller total quantities. A total of 12,000 to 34,000 metric tons of CO_2 would be emitted, primarily from vehicles.	For the Residential Scenario, emissions of the same types of pollutants as those under the Cleanup to Revised LUT Values Alternative, but in smaller total quantities. For the Open Space Scenario, emissions of the same types of pollutants as those under the Residential Scenario, but in slightly smaller total quantities. For the Residential Scenario, a total of 1,500 to 4,000 metric tons of CO_2 would be emitted, primarily from vehicles. For the Open Space Scenario, a total of 1,100 to 3,000 metric tons of CO_2 would be emitted, primarily from vehicles.
Noise	No noise impacts above baseline conditions are expected.	- Noise levels from onsite remediation are expected to increase at the closest residence during the 26 years of soil removal, but would be well below 65 dBA CNEL and would increase by less than 5 dBA CNEL (thresholds for potential adverse noise impacts established per the *LA. CEQA Thresholds Guide, Your Resource for Preparing CEQA Analyses in Los Angeles* [LA 2006]). - No adverse noise impacts from traffic noise are expected during the 26 years of soil removal, although traffic noise would increase compared to baseline conditions. Assuming an occasional peak of 32 daily heavy-duty truck round trips, time-averaged daily noise levels along the evaluated haul roads could increase by up to 1.4 dBA CNEL where the final noise level would be below 65 dBA CNEL (the threshold for an adverse impact is an increase of 5 dBA CNEL). Along one section of Valley Circle	Similar to the Cleanup to AOC LUT Values Alternative, except the duration of increased noise due to site activities or traffic would be slightly more than 6 years.	Similar to the Cleanup to AOC LUT Values Alternative, except the duration of soil removal would be less than 2 years under the Residential Scenario.

Resource Area	Alternatives				
	Soil No Action	Cleanup to AOC LUT Values	Cleanup to Revised LUT Values	Conservation of Natural Resources (Residential and Open Space Scenarios)	
		Boulevard, where the noise level already exceeds 65 dBA CNEL, the increase would be no more 1.2 dBA (the threshold for an adverse impact when the final noise level exceeds 65 dBA CNEL is an increase of 3 dBA CNEL).			
Transportation [a]	No impacts above baseline conditions are expected.	**Shipment of radioactive waste – truck option** [b] Shipments – 7,170 truck shipments *Incident-free risks:* - Crew LCFs: 0 (4×10^{-4} to 1×10^{-3}) - Population LCFs: 0 (1×10^{-4} to 3×10^{-4}) *Accident risks:* - Population LCFs: 0 (3×10^{-10} to 6×10^{-9}) - Traffic fatalities: 0 (0.05 to 0.6) **Shipment of radioactive waste – truck/rail option** [b] Shipments – 7,170 truck shipments from SSFL to an intermodal facility and then 450 rail shipments *Incident-free risks:* - Crew LCFs: 0 (1×10^{-4} to 3×10^{-4}) - Population LCFs: 0 (1×10^{-4} to 2×10^{-4}) *Accident risks:* - Population LCFs: 0 (3×10^{-10}) - Traffic fatalities: 0 (0.09 to 0.2)	**Shipment of radioactive waste – truck option** Same as the Cleanup to AOC LUT Values Alternative. **Shipment of radioactive waste – truck/ rail option** Same as the Cleanup to AOC LUT Values Alternative.	***Residential Scenario*** **Shipment of radioactive waste – truck option** [b] Shipments – 65 truck shipments *Incident-free risks:* - Crew LCFs: 0 (3×10^{-6} to 1×10^{-5}) - Population LCFs: 0 (9×10^{-7} to 3×10^{-6}) *Accident risks:* - Population LCFs: 0 (3×10^{-12} to 6×10^{-11}) - Traffic fatalities: 0 (4×10^{-4} to 5×10^{-3}) **Shipment of radioactive waste – truck/rail option** [b] Shipments – 65 truck shipments from SSFL to an intermodal facility, then 5 rail shipments *Incident-free risks:* - Crew LCFs: 0 ($1\times10^{-6}$to 3×10^{-6}) - Population LCFs: 0 (1×10^{-6} to 2×10^{-6}) *Accident risks:* - Population LCFs: 0 (3×10^{-12} to 4×10^{-12}) - Traffic fatalities: 0 (1×10^{-3} to 3×10^{-3})	***Open Space Scenario*** **Shipment of radioactive waste – truck option** [b] Shipments – 13 truck shipments *Incident-free risks:* - Crew LCFs: 0 (7×10^{-7} to 2×10^{-6}) - Population LCFs: 0 (2×10^{-7} to 6×10^{-7}) *Accident risks:* - Population LCFs: 0 (5×10^{-13} to 1×10^{-11}) - Traffic fatalities: 0 (9×10^{-5} to 1×10^{-3}) **Shipment of radioactive waste – truck/rail option** [b] Shipments –13 truck shipments from SSFL to a an intermodal facility, then 1 rail shipment *Incident-free risks:* - Crew LCFs: 0 (3×10^{-7} to 6×10^{-7}) - Population LCFs: 0 (2×10^{-7} to 4×10^{-7}) *Accident risks:* - Population LCFs: 0 (6×10^{-13} to 8×10^{-13} - Traffic fatalities: 0 (2×10^{-4} to 5×10^{-4})

Resource Area	Alternatives				
	Soil No Action	Cleanup to AOC LUT Values	Cleanup to Revised LUT Values	Conservation of Natural Resources (Residential and Open Space Scenarios)	
				Residential Scenario	*Open Space Scenario*
Transportation[a] (cont'd)		**Shipment of nonradioactive waste, backfill, equipment, and supplies [b]** *Truck option:* - 93,430 truck shipments - Traffic fatality risks: 0 (0.26) *Truck/rail option:* - 50,280 truck shipments of waste from SSFL to an intermodal facility, then 3,200 rail shipments; 43,140 truck shipments of backfill, equipment, and supplies Traffic fatality risks: 2 (2.3)	**Shipment of nonradioactive waste, backfill, equipment, and supplies [b]** *Truck option:* - 14,560 truck shipments - Traffic fatality risks: 0 (0.04) *Truck/rail option:* - 5,220 truck shipments of waste from SSFL to an intermodal facility and then 330 rail shipments; 9,340 truck shipments of backfill, equipment, and supplies Traffic fatality risks: 0 (0.24)	**Shipment of nonradioactive waste, backfill, equipment, and supplies [b]** *Truck option:* - 5,920 truck shipments - Traffic fatality risks: 0 (0.02) *Truck/rail option:* - 3,330 truck shipments of waste from SSFL to an intermodal facility and then 210 rail shipments; 2,590 truck shipments of backfill, equipment, and supplies - Traffic fatality risks: 0 (0.15)	**Shipment of nonradioactive waste, backfill, equipment, and supplies [b]** *Truck option:* - 4,400 truck shipments - Traffic fatality risks: 0 (0.02) *Truck/rail option:* - 2,480 truck shipments of waste from SSFL to an intermodal facility and then 160 rail shipments; 1,920 truck shipments of backfill, equipment, and supplies - Traffic fatality risks: 0 (0.11)
Traffic	No increases in average daily traffic or LOS are expected on roads in the SSFL vicinity, with no traffic-induced damage to road pavement.	The weekday average daily traffic on Woolsey Canyon Road would increase by up to 3.3 percent during the 26 years of soil removal. Traffic increases on other evaluated roads would be smaller. Weekday motorist delays or perceived delays could occur on Woolsey Canyon Road and at its intersection with Valley Circle Boulevard. Other than Woolsey Canyon Road and its intersection with Valley Circle Boulevard, traffic volumes on roads and intersections may be reduced by use of multiple routes between SSFL and major highways. Compared with 2018 baseline conditions, the LOS rating for Woolsey Canyon Boulevard could change from A to B during AM traffic conditions. The increase in V/C ratio for the unsignalized intersection of Woolsey Canyon Road with Valley Circle Boulevard would range from 0.07 to 0.08. Traffic growth in the SSFL area independent of DOE activities could result in increased traffic congestion in future years. For example, the intersection of Woolsey Canyon Road with Valley Circle Boulevard could operate at an F LOS rating during AM traffic conditions during most of the 26 years of soil removal. Traffic would impose about 258,000 ESALs on the	Increases in weekday average daily traffic, and potential motorist delays or perceived delays, would be similar to those under the Cleanup to AOC LUT Values Alternative, except the increased level of traffic would last for about 6 years. Traffic increases on other evaluated roads would be smaller. Other than Woolsey Canyon Road and its intersection with Valley Circle Boulevard, traffic volumes on roads and intersections may be reduced by use of multiple routes between SSFL and major highways. Potential changes in LOS ratings and V/C ratios would be similar to the Cleanup to AOC LUT Values Alternative, except that because soil removal would require only 6 years, fewer intersections in the SSFL area would have LOS ratings of E or F by the time remediation is complete. However, the unsignalized intersection of Woolsey Canyon Road with Valley Circle Boulevard could operate at an F LOS rating during AM traffic conditions during some of the 6 years of soil removal. Traffic	Increases in weekday average daily traffic, and potential motorist delays or perceived delays, would be similar to those under the Cleanup to AOC LUT Values Alternative, except the increased level of traffic would last for about 2 years or less depending on the scenario. Other than Woolsey Canyon Road and its intersection with Valley Circle Boulevard, traffic volumes on roads and intersections may be reduced by use of multiple routes between SSFL and major highways. Potential changes in LOS ratings and V/C ratios would be similar to the Cleanup to Revised LUT Values Alternative, except that because soil removal would require up to 2 years, fewer intersections in the SSFL area would have LOS ratings of E or F by the time remediation is complete. Under the Residential and Open Space Scenarios, traffic would impose about 15,000 and 11,000 ESALs, respectively, on the evaluated roads, which would likely cause less road pavement damage than that under the Cleanup to AOC LUT Values Alternative, but could still result in the affected roads needing repair sooner than currently anticipated.	

Resource Area	Alternatives			
	Soil No Action	**Cleanup to AOC LUT Values**	**Cleanup to Revised LUT Values**	**Conservation of Natural Resources (Residential and Open Space Scenarios)**
		evaluated roads, which would likely have adverse impacts on road pavement and result in the affected roads needing repair sooner than currently anticipated.	would impose about 56,000 ESALs on the evaluated roads, which would likely cause less road pavement damage than that under the Cleanup to AOC LUT Values Alternative, but could still result in the affected roads needing repair sooner than currently anticipated.	
Human health	**Workers** Minimal exposures from monitoring and maintenance activities; maintenance workers would be protected from chemical and radiation exposure and industrial hazards through compliance with DOE requirements for worker safety and radiation protection.	**Workers** Exposures would be higher than those under the Soil No Action Alternative during 26 years of soil remediation. Remediation workers would be protected from chemical and radiation exposure through compliance with DOE requirements for worker safety and radiation protection. Radiation protection practices would be employed so that doses are ALARA.	**Workers** The duration of higher exposures would be 6 years. Workers would have less exposure to chemically impacted soil than under the Cleanup to AOC LUT Values Alternative; exposure to radioactive constituents would be the same. Remediation worker protection would be the same as that under the Cleanup to AOC LUT Values Alternative.	**Workers** The duration of higher exposures would be 2 years or less. Workers would have less exposure to chemical and radioactive constituents than under the Cleanup to Revised LUT Values Alternative. Remediation worker protection would be the same as that under the Cleanup to AOC LUT Values Alternative.
	Valley fever [c] There would be no change in the risk of exposure to the fungus spores that cause valley fever.	**Valley fever** The potential for exposure of workers and the public to fungus spores would be managed through control of fugitive dust, but would be largest among the action alternatives because of the volume of soil that would be disturbed (881,000 cubic yards).	**Valley fever** The potential for exposure of workers and the public to fungus spores would be managed through control of fugitive dust and would be about 1/5 of that under the Cleanup to AOC LUT Values Alternative because the volume of soil that would be disturbed would be less (190,000 cubic yards).	**Valley fever** The potential for exposure of workers and the public to fungus spores would be the lowest among the action alternatives because the smallest volume of soil would be disturbed (38,200 cubic yards under the Open Space Scenario to 52,000 cubic yards under the Residential Scenario).
	Members of the public [d] *Hypothetical Onsite Suburban Resident* – Total COC cancer risks from chemicals and/or radionuclides [d] in Area IV ranges from 5 times greater than the threshold for comparison (1×10^{-6}) to an order of magnitude above the threshold for acceptable impacts ($<1\times10^{-4}$), while the toxicity ranges from less than 1.0 to 100. Based 19 example exposure areas;	**Members of the public** *Hypothetical Onsite Suburban Resident and Recreator* – Chemically and radioactively impacted soil exceeding AOC LUT values would be removed. Thereafter, total COC cancer risks from chemicals and/or radionuclides in Area IV and the NBZ ranges in the 19 example exposure units from less than the threshold for comparison (1×10^{-6}) to within the acceptable range for evaluated alternatives (10^{-6} to 10^{-4}), while the toxicity range does not equal or exceed 1.0. Cancer risk: 4×10^{-7} to 5×10^{-5} Hazard index: 0.05 to 0.9	**Members of the public** *Hypothetical Onsite Suburban Resident and Recreator* – Chemically impacted soil exceeding revised LUT values would be removed, as would radioactively contaminated soil exceeding AOC LUT values. Thereafter, total COC cancer risks from chemicals and/or radionuclides in Area IV and the NBZ ranges in the 19 example exposure units from less than the threshold for comparison (1×10^{-6}) to within the acceptable range for evaluated alternatives (10^{-6} to 10^{-4}),	**Members of the public** *Hypothetical Onsite Suburban Resident and Recreator* – Chemically and radioactively impacted soil exceeding risk/dose assessment-based values would be removed. Thereafter for both scenarios, total COC cancer risks from chemicals and/or radionuclides in Area IV and the NBZ ranges in the 19 example exposure units from equal to the impact threshold value to less than the threshold for comparison (1×10^{-6}) to within the acceptable range for evaluated alternatives (10^{-6} to 10^{-4}), while the toxicity range does not exceed 1.0. <u>Residential Scenario (Resident):</u> Cancer risk: 1×10^{-6} to 5×10^{-5} Hazard index: 0.06 to 1.0 <u>Open Space Scenario (Recreator):</u> Cancer risk: 3×10^{-7} to 1×10^{-5}

Resource Area	Alternatives			
	Soil No Action	**Cleanup to AOC LUT Values**	**Cleanup to Revised LUT Values**	**Conservation of Natural Resources (Residential and Open Space Scenarios)**
	Cancer risk: 5×10^{-6} to 2×10^{-3} Hazard index: 0.1 to 100 *Hypothetical Onsite Recreational User* – Cancer risk and toxicity impacts from chemical and/or radionuclides [e] in Area IV and the NBZ are comparable to or less than those determined for background soil. Based 19 example exposure areas; Cancer risk: 1×10^{-6} to 2×10^{-4} Hazard index: 0.02 to 30. *Offsite Suburban Resident and Recreational User* - The impacts are 5 to 6 orders of magnitude less than all thresholds for impact comparison which is considered insignificant impact. Suburban Resident: Cancer risk: 1.2×10^{-11} Hazard Index: 2.0×10^{-7} Recreator: Cancer risk: 5.0×10^{-12} Hazard Index: 4.8×10^{-8}	*Offsite Suburban Resident and Recreational User* - The impacts are 5 to 6 orders of magnitude less than all thresholds for impact comparison which is considered insignificant impact. Suburban Resident: Cancer risk: 9.8×10^{-11} Hazard Index: 1.8×10^{-6} Recreator: Cancer risk: 4.8×10^{-11} Hazard Index: 5.0×10^{-7}	while the toxicity range does not equal or exceed 1.0. Cancer risk: 5×10^{-7} to 5×10^{-5} Hazard index: 0.06 to 0.9 *Offsite Suburban Resident and Recreational User* - The impacts are 5 to 6 orders of magnitude less than all thresholds for impact comparison which is considered insignificant impact. Suburban Resident: Cancer risk: 3.0×10^{-11} Hazard Index: 1.4×10^{-6} Recreator: Cancer risk: 1.3×10^{-11} Hazard Index: 7.4×10^{-7}	Hazard index: 0.01 to 0.3 *Offsite Suburban Resident and Recreational User* - The impacts are 5 to 6 orders of magnitude less than all thresholds for impact comparison which is considered insignificant impact. *Residential Scenario* Suburban Resident: Cancer risk: 1.4×10^{-11} Hazard Index: 2.3×10^{-6} *Open Space Scenario* Cancer risk: 1.1×10^{-11} Hazard Index: 3.4×10^{-6} Recreator: *Residential Scenario* Cancer risk: 5.8×10^{-12} Hazard Index: 1.5×10^{-6} *Open Space Scenario* Cancer risk: 4.5×10^{-12} Hazard Index: 2.4×10^{-6}
Waste management	Very small quantities of waste from site maintenance activities may be annually generated, which would be transported to offsite waste management facilities with no impacts on the disposal capacities of these facilities.	LLW/MLLW – 110,000 cubic yards Hazardous waste – 2,000 cubic yards Nonhazardous waste – 769,000 cubic yards No exceedance of total waste capacity or a daily or annual waste acceptance limit is expected at any evaluated facility.	LLW/MLLW – 110,000 cubic yards Hazardous waste – 2,000 cubic yards Nonhazardous waste – 78,000 cubic yards No exceedance of total waste capacity or a daily or annual waste acceptance limit is expected at any evaluated facility.	*Residential Scenario:* LLW/MLLW – 1,000 cubic yards Hazardous waste – 2,000 cubic yards Nonhazardous waste – 49,000 cubic yards *Open Space Scenario:* LLW/MLLW – 200 cubic yards Hazardous waste – 2,000 cubic yards Nonhazardous waste – 36,000 cubic yards No exceedance of total waste capacity or a daily or annual waste acceptance limit is expected at any evaluated facility.

	Alternatives			
Resource Area	**Soil No Action**	**Cleanup to AOC LUT Values**	**Cleanup to Revised LUT Values**	**Conservation of Natural Resources (Residential and Open Space Scenarios)**
Cultural resources	***Architectural Resources.*** No historic properties would be affected. ***Archaeological Resources***. No historic properties would be affected. ***Traditional Cultural Resources***. No adverse impacts are expected.	***Architectural Resources.*** No historic properties would be affected by soil remediation. ***Archaeological Resources***. Should a historic property not be exempted from cleanup requirements, including any unanticipated discovery made during soil remediation, appropriate avoidance, minimization, and/or mitigation measures will be implemented in accordance with the Section 106 Programmatic Agreement currently under development. ***Traditional Cultural Resources***. Soil remediation would result in changes to the setting and general landscape (e.g., topography, soil color, vegetation) associated with traditional cultural resources at Area IV and the NBZ. Adverse impacts on the integrity of traditional cultural resources are possible from disturbance of landscape due to soil removal (881,000 cubic yards, 90 acres), increased human activity and equipment during 26 years of soil removal, augmented site access during remediation, and potential discovery of unanticipated resources during soil remediation.	***Architectural Resources.*** No historic properties would be affected by soil remediation. ***Archaeological Resources***. Similar to the Cleanup to AOC LUT Values Alternative, but with less likelihood of unanticipated discoveries during soil remediation because less area would be disturbed. ***Traditional Cultural Resources***. Adverse impacts would be similar to those under the Cleanup to AOC LUT Values Alternative, but of reduced magnitude. There would be reduced changes in setting because there would be less soil removal (190,000 cubic yards, 38 acres), less human activity and equipment (for approximately 6 years rather than 26 years), reduced duration of site access during remediation, and less potential for unanticipated discoveries.	***Architectural Resources.*** No historic properties would be affected by soil remediation. ***Archaeological Resources***. Similar to the Cleanup to AOC LUT Values Alternative, but with less likelihood of unanticipated discoveries during soil remediation because less area would be disturbed. ***Traditional Cultural Resources***. Adverse impacts would be similar to those under the Cleanup to AOC LUT Values Alternative, but of reduced magnitude. There would be reduced changes in setting because there would be less soil removal (52,000 cubic yards and 10 acres under the Residential Scenario and 38,200 cubic yards and 9 acres under the Open Space Scenario), less human activity and equipment (for 2 years or less under both scenarios), reduced duration of site access during remediation, and less potential for unanticipated discoveries.
Socioeconomics	No socioeconomic impacts on employment, businesses, infrastructure and municipal services, housing, or local government revenue are expected in Los Angeles and Ventura Counties. No traffic-related impacts are expected at offsite disposal facilities.	- Employment would increase by 25 workers for 26 years, with minor beneficial socioeconomic impacts. - Truck traffic in the SSFL vicinity would last for 26 years, but is not expected to have socioeconomic impacts on businesses on the evaluated routes between SSFL and major highways. - Traffic could damage road pavement along segments of the routes to major highways, which could affect government finances. DOE may need to negotiate with local governments to contribute its portion of the cost for maintenance and repair of affected roads. No other impacts on municipal services are expected.	- Employment would increase by 25 workers for 6 years, with minor beneficial socioeconomic impacts. - Truck traffic in the SSFL vicinity would last for about 6 years, but is not expected to have socioeconomic impacts on businesses on the evaluated routes between SSFL and major highways. - Same as the Cleanup to AOC LUT Values Alternative, except there would be fewer truck round trips, which would have a smaller potential for damage of road pavement. - Impacts on housing availability would be the same as those under	The impacts would be the same under both the Residential and Open Space Scenarios and are as follows: - Employment would increase by 25 workers for 2 years or less, with minor beneficial socioeconomic impacts. - Truck traffic in the SSFL vicinity would last for 2 years or less, but is not expected to have socioeconomic impacts on businesses on the evaluated routes between SSFL and major highways. - Same as under the Cleanup to Revised LUT Values Alternative, except there would be fewer truck round trips which would have a smaller potential for damage of road pavement. - Impacts on housing availability would be the same as those under the Cleanup to AOC LUT Values Alternative. - Potential funding impacts and benefits would be reduced compared to those under the Cleanup to Revised Alternative because of the slightly shorter operational duration of soil removal.

Resource Area	Alternatives			
	Soil No Action	Cleanup to AOC LUT Values	Cleanup to Revised LUT Values	Conservation of Natural Resources (Residential and Open Space Scenarios)
		- Workers would be primarily employed from the SSFL ROI, with no impacts on housing availability. - Revenue from taxes from purchases of materials and fuel and rental of equipment, as well as permitting fees for project activities, could increase revenues for local governments during the 26 years of soil removal. - Because there are few, if any, local businesses along the main access routes to the three evaluated LLW/MLLW disposal facilities, there would be no socioeconomic impacts on businesses in the vicinities of these facilities. Because of the small numbers of daily deliveries of soil to the evaluated hazardous waste facilities (daily average less than 1), no socioeconomic impacts are expected on businesses near these facilities For deliveries of nonhazardous soil to the evaluated facilities, which could occur up to 9 per day for most years, no or minimal socioeconomic impacts are expected on businesses near these facilities. Disposal fees could increase revenues for public or private entities. Any adverse impacts would be minimized by shipping soil waste to multiple authorized disposal facilities, by use of multiple local routes (as available) to a disposal facility, or by shipping waste by rail to rail-accessible facilities.	the Cleanup to AOC LUT Values Alternative. - Potential funding impacts and benefits would be reduced compared to those under the Cleanup to AOC LUT Values Alternative because of the shorter operational duration of about 6 years. - Potential impacts on local businesses near the disposal or recycle facilities would be similar to the Cleanup to AOC LUT Values Alternative, with the same daily deliveries over the same delivery durations to the evaluated radioactive and hazardous waste facilities, and the same lack of potential for socioeconomic impacts on businesses near these facilities. There would be a similar peak delivery rate to the evaluated nonhazardous waste facilities (up to 9 per day), but this rate of waste delivery would last for only 1 year; over the other 5 years of delivery, the daily rate would range from 1 to 4. No or minimal socioeconomic impacts are expected on businesses near these facilities There would be reduced disposal fees at the evaluated hazardous waste facilities.	- Potential impacts on local businesses near the disposal or recycle facilities would be similar to the Cleanup to Revised LUT Values Alternative, except that the total number of shipments to radioactive waste facilities would be substantially reduced for both scenarios, meaning that disposal fees that could provide revenues for public or private entities would be reduced. No socioeconomic impacts on local businesses are expected for delivery to any evaluated LLW/MLLW or hazardous waste facility. No or minimal socioeconomic impacts are expected on businesses near the evaluated nonhazardous waste facilities.

Resource Area	Alternatives			
	Soil No Action	***Cleanup to AOC LUT Values***	***Cleanup to Revised LUT Values***	***Conservation of Natural Resources (Residential and Open Space Scenarios)***
Environmental justice	- Potential risks to a hypothetical (after 100 years) onsite suburban resident or recreational user would be extremely low (see Human Health). No disproportionately high and adverse impacts are expected on minority or low-income populations, including Native American tribes, in the SSFL ROI. - No traffic impacts above baseline conditions are expected in the SSFL ROI. No disproportionately high and adverse impacts are expected on minority or low-income populations, including Native American tribes, in the SSFL ROI. - No traffic impacts above baseline conditions are expected in the regional ROIs. No disproportionately high and adverse impacts are expected on minority or low-income populations, including Native American tribes, in the regional ROIs.	- After remediation, potential risks to a hypothetical onsite suburban resident or recreational user would be extremely low. No disproportionately high and adverse impacts are expected on minority or low-income populations, including Native American tribes, in the SSFL ROI. - During the 26 years of soil removal, weekday traffic in the SSFL ROI would increase, but the evaluated routes would traverse minority and non-minority communities, as well as low-income and non-low-income communities, and would not pass through Native American lands. This indicates that traffic impacts on Native America, minority, or low-income populations would be the same as those experienced by the general population. No disproportionately high and adverse impacts are expected in the SSFL ROI. - There would be no noticeable increase in traffic in the vicinities of the disposal facilities evaluated for receipt of radiologically contaminated or hazardous soil, and no or minimal impacts in the vicinities of the facilities evaluated for receipt of nonhazardous soil. By using multiple disposal facilities or rail transport to rail-accessible facilities, traffic in the vicinities of the evaluated disposal facilities could be reduced. No disproportionately high and adverse impacts are expected on minority or low-income populations, including Native American tribes, in the regional ROIs.	- Potential impacts on minority or low-income populations, including Native American tribes, in the SSFL ROI and in the vicinities of the disposal facilities would be similar to those under the Cleanup to AOC LUT Values Alternative, except that they would last for about 6 years. No disproportionately high and adverse impacts are expected on minority or low-income populations, including Native American tribes.	The impacts would be the same under both the Residential and Open Space Scenarios and are as follows: - Potential impacts on minority or low-income populations, including Native American tribes, in the SSFL ROI and in the vicinities of disposal facilities would be similar to those under the Cleanup to AOC LUT Values Alternative, except that they would last for 2 years or less. No disproportionately high and adverse impacts are expected on minority or low-income populations, including Native American tribes.

Resource Area	Alternatives			
	Soil No Action	***Cleanup to AOC LUT Values***	***Cleanup to Revised LUT Values***	***Conservation of Natural Resources (Residential and Open Space Scenarios)***
Sensitive-aged populations	- No traffic impacts above baseline conditions are expected in the SSFL ROI, with no disparate impacts (markedly distinct impacts relative to those on the general population) on sensitive-aged populations. - No traffic impacts above baseline conditions are expected in the regional ROIs, with no disparate impacts on sensitive-aged populations.	- During the 26-year duration of soil removal, there could be an increased risk to pedestrians along or crossing Woolsey Canyon Road, but this risk would be experienced by persons of all ages. There is not expected to be a significantly larger population of sensitive-aged persons in the group that could experience this risk compared to groups of persons living elsewhere in the SSFL ROI. Traffic volumes, and therefore risks to pedestrians, along other evaluated routes are not expected to be noticeably larger than those under baseline conditions. No disparate impacts on sensitive-aged populations are expected in the SSFL ROI. - There would be no or minimal impacts due to increased traffic in the regional ROIs. Using multiple facilities or rail transport to rail-accessible facilities, traffic may be reduced along any route that may pass near a school or recreation area. No disparate impacts are expected on sensitive-aged populations in the regional ROIs.	- Impacts in the SSFL ROI would be similar to those under the Cleanup to AOC LUT Values Alternative, except that increased traffic would occur for about 6 years rather than 10 years. - There would be similar traffic increases in the regional ROIs for radioactive, hazardous, and nonhazardous waste disposal facilities compared to the Cleanup to AOC LUT Values Alternative, but soil removal and associated increased traffic would occur for a much shorter duration. No disparate impacts are expected on sensitive-aged populations in the regional ROIs	The impacts would be the same under both the Residential and Open Space Scenarios and are as follows: - Impacts in the SSFL ROI would be similar to those under the Cleanup to AOC LUT Values Alternative, except that increased traffic would occur for about 2 years under the Residential Scenario or less than 2 years under the Open Space Scenario. Under both scenarios, similar traffic increases in the regional ROIs for radioactive, hazardous, and nonhazardous waste disposal facilities as the Cleanup to Revised LUT Values Alternative, except that soil removal and associated increased traffic would occur for shorter durations. No disparate impacts are expected on sensitive-aged populations in the regional ROIs.

ALARA = as low as reasonably achievable; AOC = *Administrative Order on Consent for Remediation*; BMP = best management practice; Boeing = The Boeing Company; CO = carbon monoxide; CO_2 = carbon dioxide; CMWD = Calleguas Municipal Water District; CNEL = community noise equivalent level; dBA = decibels A-weighted; ESAL = equivalent single axle load; LCF = latent cancer fatality; LLW = low-level radioactive waste; LOS = level of service; LUT = Look-Up Table; MLLW = mixed low-level radioactive waste; NBZ = Northern Buffer Zone; NO_X = nitrogen oxides; NPDES = National Pollutant Discharge Elimination System; ROI = region of influence; SO_2 = sulfur dioxide; V/C ratio = volume-to-capacity ratio; VOC = volatile organic compound.

[a] "Exemption areas" refers to areas that are identified for the protection of biological and cultural resources in accordance with the 2010 AOC (DTSC 2010a). DOE would not take action in the areas where the exemption process would be applied unless it is demonstrated that levels of chemical or radioactive constituents in the soil would pose a risk to human health or the environment, as determined using risk-based screening levels from the *Final Standardized Risk Assessment Methodology Revision 2 Addendum, Santa Susana Field Laboratory, Ventura County, California* (MWH 2014).

[b] Transportation risks are presented as whole numbers with the actual calculated values presented in parentheses. Values in parentheses that have a negative power of 10 are less than 1. The larger the negative value of 10, the smaller the number.

[c] Valley fever is the initial form of coccidioidomycosis infection, a fungal infection caused by inhalation of airborne *Coccidioides* spp. spores that are present in certain arid soils. Spores from the fungus are found in the top 2 to 12 inches of soil in many parts of arid United States southwest. When soil containing this fungus is disturbed by activities such as digging or by the wind, the fungal spores can get into the air (CDC 2014; HESIS 2013).

[d] Because members of the public would be restricted from accessing the site through fencing, signage, and routine patrols by site security personnel, and DOE's intent would be to prevent public access to the site, impacts calculated for the onsite suburban resident and recreational user under the Soil No Action Alternative are hypothetical.

[e] All impacts for soil constituents are based on the 95% Upper Confidence Limit (UCL95) on the mean concentration for al constituents that had a frequency of detection greater than 2.5 percent for chemicals or 5 percent for radionuclides (based on expected frequency of false detection) for analytes that passed data validation and data quality assessment screening (Leidos 2018).

[f] All cancer risks presented in this summary table are combined risks from chemicals and radionuclides. The contributions from each are shown in the tables below. See cautions about combining chemical and radionuclide risks in Section 4.9.5.1.

Table S–8 Summary of Potential Environmental Consequences under the Building Demolition Alternatives

	Alternatives	
Resource Area	***Building No Action***	***Building Removal***
Land resources	- Land use would be consistent with the Ventura County general plan designation for SSFL as open space; although it is zoned rural agriculture and open space; a special use permit currently allows industrial uses (Ventura County 2011a, 2015a). Land use would also be consistent with Boeing's two Grant Deeds of Conservation Easement and Agreement with the North American Land Trust that permanently preserves most of SSFL as open space and prohibits the use of the site for agricultural or residential development (Ventura County 2017a, 2017b).No impacts are expected on use of Sage Ranch Park or other recreation areas in the SSFL vicinity. - Electrical service to DOE-owned buildings would be severed, but electrical service in Area IV would remain. Electrical and water requirements would continue to be minimal. - No short-term changes to the aesthetics and visual quality of Area IV are expected, but DOE-owned buildings could dilapidate over time, decreasing aesthetics and visual quality.	- Land use before and after building demolition would be consistent with Ventura County's existing general plan designation and zoning, and with Boeing's two Grant Deeds of Conservation Easement and Agreement with the North American Land Trust that permanently preserves most of SSFL as open space and prohibits the use of the site for agricultural or residential development (Ventura County 2017a, 2017b). - During the 2 to 3 years required for building demolition, the average daily traffic on Woolsey Canyon Road would increase by up to 5.2 percent above baseline conditions. The traffic associated with this alternative could result in traffic delays or the perception of delays that could discourage weekday use of Sage Ranch Park, but the potential for delays or perception of delays would likely be less than that for any of the soil remediation action alternatives. There is less potential for discouraged weekday use of other recreational areas in the SSFL vicinity; nonetheless, traffic on other roads past other recreation areas may be reduced by routing truck traffic among multiple routes between SSFL and major highways. - Annual electricity requirements would be minimal. Up to about 250,000 gallons of water from CMWD would be annually used (630,000 gallons total). Water use is an important consideration because of California's drought conditions which culminated in local and State-wide measures to significantly reduce water consumption. There would be impacts on views of Area IV during the 2 to 3 years of building demolition, but long-term improvements to Area IV visual quality from returning the area to a stabilized, revegetated state.
Geology and soils	No impacts on geologic and paleontological resources are expected and no worker activities would take place in zones where earthquake-induced landslides could occur. No impacts from soil erosion or loss of soil function are expected, and there would be no need for backfill obtained from offsite sources.	- No adverse impacts are expected on bedrock geologic resources. - Minimal impacts are expected on paleontological resources during building removal. - No risks to workers are expected from potential earthquake-induced landslides, because building removal would occur outside of zones where such landslides could occur; however, in the event of an earthquake there could be a risk to demolition workers resulting from building collapse. - Soil erosion would be minimized using BMPs as summarized in Chapter 6. However, in the period between building removal and completion of site stabilization efforts, disturbed soil could erode, leading to some reduction of soil quality and functional capability within eroded areas. Because most of the area to be disturbed is currently occupied by buildings or asphalt, soil quality and functional capability within potentially eroded areas would likely be already reduced compared to that before development of Area IV. - Up to 13,500 cubic yards of backfill would be required with chemical and radioactive constituents in concentrations meeting prescribed values (e.g., AOC LUT, revised LUT, or risk-assessment-based values).[a] The biological activity, filtration, and vegetation support quality of the backfill received from offsite sources may be less than that of current soil at Area IV. As noted above, some degradation of soil quality and functional capability within the area to be disturbed has probably already occurred.
Surface water resources	No changes in surface water quality and stormwater runoff quantity and velocity from baseline conditions are expected. Sources of potential surface water contamination would remain.	During building demolition, no adverse impacts on surface water quality are expected from stormwater runoff. Sources of potential surface water contamination would be removed. No increases in runoff quantity and velocity are expected that could overwhelm SSFL or regional stormwater control capacities.

Resource Area	Alternatives		
	Building No Action	***Building Removal***	
Groundwater resources	No adverse impacts on groundwater quality and quantity are expected.	No adverse impacts are expected on groundwater quality. This alternative may require dewatering of the basement of Building 4024 to enable safe demolition. If this occurs, up to 200,000 gallons of groundwater could be withdrawn from Area IV that would be managed by methods such as treatment (as needed) and onsite discharge.	
Biological resources	No adverse impacts on vegetation and wildlife habitat and biota; aquatic and wetland habitats and biota; or threatened, endangered, or rare species are expected.	- Removal of buildings would not be expected to cause measureable loss of native plant and wildlife communities, although habitat would be lost for native wildlife species using the buildings for roosting or nesting, with potential disturbance of protected nesting species. There would be offsetting beneficial impacts on native wildlife from elimination of habitat for nuisance species and creation of restored habitat after the buildings are removed. If backfill is substantially different from soil present before development of Area IV, it may not support restoration of vegetation similar to that previously present. - Wetlands or jurisdictional waters of the U.S. would not be directly impacted. Existing drainage structures and impervious surfaces may be removed, but replaced by more natural drainage patterns. Indirect impacts from runoff would be minimized by use of BMPs and mitigation measures. - Impacts on special-status animal species or their habitats would be short-term, may be mitigated or avoided, and would be unlikely to result in take of listed wildlife species. No federally or State listed wildlife species are known or expected to use the existing buildings. Adverse impacts on individual State-listed as rare Santa Susana tarplants could occur if they are established next to buildings at the time that demolition occurs. No other special-status plant species are likely to be impacted because none have been observed or would be expected in the already disturbed areas adjacent to the buildings.	
Air quality and climate	No emissions of airborne pollutants, including greenhouse gases, above baseline conditions are expected.	Emissions of pollutants such as VOCs, CO, NOx, SO_2, and particulates would occur from onsite activities, with nearly all particulate emissions arising from fugitive dust; additional emissions would occur from vehicles, including those transporting waste and backfill. A total of 4,400 to 7,100 metric tons of CO_2 would be emitted, primarily from vehicles.	
Noise	No noise impacts above baseline conditions from onsite activities or from traffic to and from SSFL are expected.	Under the Building Removal Alternative, noise emanating from Area IV would increase compared to that under the Building No Action Alternative, but would not be expected to cause adverse impacts at the nearest residence to Area IV. Increased traffic under the Building Removal Alternative compared to baseline conditions is not expected to result in adverse noise impacts along the evaluated routes between SSFL and major highways (see Section 2.8.1.1).	
Transportation [b]	No impacts above baseline conditions are expected.	**Shipment of radioactive waste – truck option** [b] Shipments – 1,030 truck shipments *Incident-free risks:* - Crew LCFs: 0 (5×10^{-5} to 2×10^{-4}) - Population LCFs: 0 (1×10^{-5} to 5×10^{-5}) *Accident risks:* - Population LCFs: 0 (4×10^{-11} to 9×10^{-10}) - Traffic fatalities: 0 (7×10^{-3} to 8×10^{-2})	**Shipment of radioactive waste – truck/rail option** [b] Shipments – 1,030 truck shipments from SSFL to an intermodal facility, then 65 rail shipments *Incident-free risks:* - Crew LCFs: 0 (2×10^{-5} to 4×10^{-5}) - Population LCFs: 0 (2×10^{-5} to 3×10^{-5}) *Accident risks:* - Population LCFs: 0 (3×10^{-11} to 5×10^{-11}) - Traffic fatalities: 0 (1×10^{-2} to 3×10^{-2})

Resource Area	Alternatives	
	Building No Action	**Building Removal**
		Shipment of nonradioactive waste, backfill, equipment, and supplies [b] *Truck option:* - 1,400 truck shipments of waste, backfill, equipment, and supplies - Traffic fatality risks: 0 (2.3×10^{-3}) *Truck/rail option:* - 130 truck shipments of hazardous/nonhazardous waste from SSFL to an intermodal facility, and then 10 rail shipments; plus 1,260 truck shipments of recyclable material, backfill, equipment, and supplies - Traffic fatality risks: 0 (7.4×10^{-3})
Traffic	No increases in average daily traffic or LOS on roads in the SSFL vicinity are expected, with no traffic-induced damage to road pavement.	The weekday average daily traffic on Woolsey Canyon Road would increase by up to 5.2 percent above baseline conditions during the 2 to 3 years required for building removal. Because of the presence of slow-moving heavy duty trucks, there could be weekday motorist delays or perceived delays on this road and its intersection with Valley Circle Boulevard. Traffic increases on other roads would be smaller. Except for Woolsey Canyon Road and its intersection with Valley Circle Boulevard, traffic on roads and intersections may be reduced by distributing traffic among multiple routes between SSFL and major highways. There could be a change in the LOS rating for Woolsey Canyon Road from A to B during AM traffic conditions. This may be more likely on a limited number of days when the daily number of truck shipments could spike to 12. Because the Building Removal Alternative would be initiated early in the remediation of Area IV and the NBZ (in 2018 or 2019) and because of the 2 to 3 year duration of the activity, it may be completed before most of the assumed 1 percent growth in SSFL area traffic would occur (see Section 4.8.2, "Traffic Congestion"). During the period of building removal, the intersection of Woolsey Canyon Road with Valley Circle Boulevard could operate at a D to E rating during AM traffic conditions and a C rating during PM traffic conditions. Traffic would impose about 6,200 ESALs on the evaluated roads, with some adverse impacts on road pavement resulting in the impacted roads needing repair sooner than currently anticipated.
Human health	**Workers** Exposures from monitoring and maintenance activities would be minimal. Workers would be protected from radiation exposure and industrial hazards through compliance with DOE requirements for worker safety and radiation protection. **Members of the public** *Onsite Suburban Resident and Recreational User* – No impacts are expected because access to the buildings would be restricted. *Offsite Suburban Resident and Recreational User* – The impacts are 1 to 3 orders of magnitude less than all thresholds for impact comparison which is considered insignificant impact.	**Workers** Conservatively assuming no reduction in exposure as D&D progresses, impacts would be: *Individual worker* - Dose: 250 millirem per year - Cancer Incidence Risk: 1.2×10^{-4} (1 in 8,300) Building demolition workers would be protected from radiation exposure and industrial hazards through compliance with DOE requirements for worker safety and radiation protection. **Members of the public** *Onsite Suburban Resident and Recreational User* – No impacts are expected during building removal. Following building removal, there would be no impacts attributable to the buildings to a hypothetical onsite suburban resident or recreational user. Any residual impacts would be associated with chemicals or radionuclides in the soil (see Section 2.8.1.1). *Offsite Suburban Resident and Recreational User* – The impacts are 1 to 3 orders of magnitude less than all thresholds for impact comparison which is considered insignificant impact. <u>Resident:</u> - Radiological cancer risk: 1.0×10^{-7} - Radiological dose: 5.0×10^{-7} millirem

Resource Area	Alternatives	
	Building No Action	***Building Removal***
		Recreator: - Radiological cancer incidence risk: 8.2×10^{-9} - Radiological dose: 2.7×10^{-1} millirem
Waste management	Very small quantities of waste from site maintenance activities may be annually generated, which would be transported to offsite waste management facilities with no impacts on the disposal capacities of these facilities.	LLW/MLLW – 10,600 cubic yards Hazardous waste – 120 cubic yards Nonhazardous waste – 1,220 cubic yards Recyclable material – 3,540 cubic yards No exceedance of total waste capacity or a daily or annual waste acceptance limit is expected at any evaluated facility.
Cultural resources	***Architectural Resources.*** No historic properties would be affected. ***Archaeological Resources***. No historic properties would be affected. ***Traditional Cultural Resources***. No adverse impacts are expected, although buildings would remain that may be considered intrusive in the context of the viewscape of traditional cultural resources.	***Architectural Resources.*** No historic properties would be affected. ***Archaeological Resources***. No adverse impacts are expected because no archaeological sites are located in the immediate vicinity of buildings to be demolished, and there is low likelihood of unanticipated discoveries during building removal. ***Traditional Cultural Resources***. Removal of structures could be considered beneficial because potentially intrusive structural elements would be eliminated from the viewscape of traditional cultural resources.
Socioeconomics	No socioeconomic impacts on employment, regional truck traffic, infrastructure and municipal services, housing, and local government revenue are expected in Los Angeles and Ventura Counties. No socioeconomic impacts are expected on businesses in the vicinities of the offsite recycle and disposal facilities.	- Building removal would employ up to 60 workers with minor beneficial socioeconomic impacts. - Increased traffic during the 2 to 3 years of building demolition is not expected to have socioeconomic impacts on businesses along the evaluated routes between SSFL and major highways. - Road pavement deterioration would increase expenses for local governments. DOE may need to negotiate with local governments to contribute its portion of the cost for maintenance and repair of affected roads. No other impacts are expected on municipal services such as police or fire services. - Because workers would be primarily employed from Los Angeles and Ventura Counties, workers would already be living in the ROI and would not need new housing. Therefore, there would be no impacts on housing availability. - Potential increased expenses for local governments in the SSFL ROI due to pavement deterioration could be countered by potential increased tax revenues due to purchases of materials and fuel and rental of equipment, as well as permitting fees for project activities. - No noticeable increases in traffic volumes are expected at the evaluated recycle and disposal facilities, with no expected socioeconomic impacts on businesses in the regional ROIs.

Resource Area	Alternatives	
	Building No Action	**Building Removal**
Environmental justice	No human health impacts are expected on members of the public. There would be no increases in traffic above baseline conditions in the SSFL and regional ROIs, and thus, no additional traffic-related impacts. Therefore, no disproportionately high and adverse impacts are expected on Native American tribes and minority or low-income populations in the SSFL ROI and the regional ROIs.	- No impacts are expected on members of the public during building removal; following building removal, there would be no impacts on an onsite suburban resident or recreational user that would be attributable to the buildings. Therefore, no high and disproportionate adverse impacts are expected on minority or low-income populations, including Native American tribes, in the SSFL ROI. - Traffic in the SSFL ROI would increase, but the evaluated routes between SSFL and major highways would traverse minority and non-minority communities, as well as low-income and non-low-income communities, and would not pass through Native American lands. This indicates that traffic impacts on minority, low-income, or Native American populations would be the same as those experienced by the general population. Therefore, no disproportionately high and adverse traffic-related impacts are expected on minority or low-income populations, including Native American tribes, in the SSFL ROI. - There would be no noticeable increase in heavy-duty truck traffic in the vicinities of the evaluated recycle and disposal facilities. Nonetheless, use of multiple facilities or rail transport to rail-accessible facilities would reduce truck traffic in the vicinities of the evaluated facilities. Therefore, no disproportionately high and adverse impacts are expected on minority or low-income populations, including Native American tribes, in the regional ROIs.
Sensitive-aged populations	There would be no increases in traffic above baseline conditions in the SSFL ROI or the regional ROIs, and thus, no disparate impacts (markedly distinct impacts relative to those on the general population) are expected on sensitive-aged populations.	- Assuming shipment of waste and backfill during the 2- to 3-year period of building demolition, there could be an increased risk to pedestrians along or crossing Woolsey Canyon Road, but this risk would be experienced by persons of all ages on all roads and intersections, except Woolsey Canyon Road and its intersection with Valley Circle Boulevard. Traffic volumes on SSFL-area roads and intersections could be reduced by using multiple routes to the major highway systems, which would reduce traffic along any route that may pass by or near a school or recreational area. Therefore, no disparate impacts on sensitive-aged populations are expected in the SSFL ROI. - There would be no noticeable increase in heavy-duty truck traffic in the vicinities of the evaluated recycle and waste disposal facilities. Nonetheless, use of multiple recycle and disposal facilities or rail transport to rail-accessible facilities could reduce traffic through communities or locations (e.g., schools, recreation areas) where sensitive-aged populations may be present along the transit routes. Therefore, no disparate impacts are expected on sensitive-aged populations in the regional ROIs.

AOC = *Administrative Order on Consent for Remediation*; BMP = best management practice; Boeing = The Boeing Company; CO = carbon monoxide; CO_2 = carbon dioxide; CMWD = Calleguas Municipal Water District; CNEL = Community Noise Equivalent Level; D&D = decontamination and decommissioning; dBA = decibels A-weighted; ESAL = equivalent single axle load; LCF = latent cancer fatality; LLW = low-level radioactive waste; LOS = level of service; LUT = Look-Up Table; MBTA = Migratory Bird Treaty Act; MLLW = mixed low-level radioactive waste; NOx = nitrogen oxide; ROI = region of interest; SO_2 = sulfur dioxide; VOC = volatile organic compound.

[a] Estimates of backfill volume range from 8,140 cubic yards to 13,500 cubic yards (see Appendix D); the larger estimate (13,500 cubic yards) was used for analysis in this EIS.

[b] Transportation and human health population risks are presented as whole numbers with the actual calculated values presented in parentheses. Values in parentheses that have a negative power of 10 are less than 1. The larger the negative value of 10, the smaller the number.

Table S–9 Summary of Potential Environmental Consequences under the Groundwater Remediation Alternatives

Resource Area	*Alternatives*		
	Groundwater No Action	***Groundwater Monitored Natural Attenuation***	***Groundwater Treatment***
Land resources	- Land use for Area IV and the NBZ would be consistent with the existing Ventura County general plan designation and zoning, and with Boeing's two Grant Deeds of Conservation Easement and Agreement with the North American Land Trust that permanently preserves most of SSFL as open space and prohibits the use of the site for agricultural or residential development (Ventura County 2017a, 2017b). - No impacts on use of Sage Ranch Park or other recreation areas in the SSFL vicinity are expected. - Electrical and water requirements would continue to be minimal. - There would be no change in Area IV aesthetics and visual quality from baseline conditions.	- No change is expected in land use designation. - Remediation under this alternative would be consistent with existing general plan designations, zoning and the least consistent with the landowner's (Boeing's) April 2017 Grant Deed and Easement with the North American Land Trust (Ventura County 2017a, 2017b) than any of the other alternative. - The minimal additional traffic would not restrict access to, or impact activities at, Sage Ranch Park or other recreation areas in the SSFL vicinity. - Electricity requirements would be minimal. A total of 5,000 gallons of water from CMWD would be used during installation of 5 monitoring wells, which would represent about 1×10^{-5} percent of CMWD's annual supply. - There would be visual impacts during well installation due to views of drill rigs and supporting equipment. These impacts would occur for less than 1 year. Monitoring activities would not alter Area IV aesthetics or visual quality compared to baseline conditions.	- No change is expected in land use designation. - Remediation under this alternative would be consistent with existing general plan designations, zoning and most consistent with the landowner's (Boeing's) April 2017 Grant Deed and Easement with the North American Land Trust (Ventura County 2017a, 2017b) than any of the other alternative. - Traffic volumes would be larger than those under the Groundwater Monitored Natural Attenuation Alternative, but would not restrict access to, or impact activities at, Sage Ranch Park or other recreation areas in the SSFL vicinity. - Electricity requirements would be minimal. A total of 24,000 gallons of water from CMWD would be used for dust suppression during bedrock removal, which would represent about 6×10^{-5} percent of CMWD's annual supply. - There would be visual impacts during groundwater treatment system construction and operation due to the presence of water storage tanks, treatment units and other structures, and overland piping. These impacts would occur during a few weeks of treatment system installation followed by 5 years of treatment system operation. Long-term views at Area IV would be similar to baseline conditions.
Geology and soils	No impacts on geologic (bedrock) and paleontological resources are expected. No activities would take place in zones where earthquake-induced landslides could occur. No soil erosion or loss of soil function is expected from well monitoring activities, and there would be no need for backfill obtained from offsite sources.	Same as the Groundwater No Action Alternative, except there would be a minimal potential for soil erosion and loss of soil function during well installation.	- Loss of 3,000 cubic yards of subsurface bedrock. - No impacts are expected on paleontological resources. - No activities would take place in zones where earthquake-induced landslides could occur. - Minimal risk of soil loss due to erosion. - Loss of soil function may occur at some treatment system locations during the installation of groundwater treatment systems (projected to be up to 2 weeks for each system) followed by 5 years of treatment system operation. - About 3,000 cubic yards of backfill would be required with chemicals and radionuclides in concentrations meeting prescribed values (e.g., AOC LUT, revised LUT, or risk-assessment-based values).

Resource Area	Alternatives		
	Groundwater No Action	***Groundwater Monitored Natural Attenuation***	***Groundwater Treatment***
Surface water resources	No short-term changes from baseline conditions on surface water quality are expected, although there would be a long-term reduction of sources of potential surface water contamination (groundwater seeps). No change from baseline conditions is expected on stormwater runoff quantity and velocity.	No adverse impacts on surface water quality during well installation and well monitoring. Long-term reduction of sources of potential surface water contamination. No adverse impacts are expected on SSFL or regional stormwater control capacities.	No adverse impacts on surface water quality during treatment system installation and operation. The time required to eliminate sources of potential surface water contamination would be much shorter than that under the Groundwater Monitored Natural Attenuation Alternative. No adverse impacts are expected on SSFL or regional stormwater control capacities.
Groundwater resources	No additional adverse impacts on groundwater quality are expected. Groundwater quality would improve over time as chemical and radioactive constituents attenuate or decay. There would be no requirement to withdraw site groundwater above baseline conditions.	Same impacts on groundwater quality as the Groundwater No Action Alternative. There could be slightly increased withdrawals of Area IV groundwater as part of groundwater monitoring operations.	No adverse impacts are expected. Positive long-term impacts to groundwater quality would result from removal of contamination sources or treatment of groundwater. No adverse impacts to groundwater quantity are expected if water is treated and re-injected on site. Onsite discharge to surface water or offsite disposal would reduce local quantity by the amount discharged or transported.
Biological resources	Minor adverse impacts on vegetation and wildlife habitat and biota would occur from groundwater monitoring operations. No adverse impacts on aquatic and wetland habitats and biota or threatened, endangered, or rare species are expected.	Five new wells would be installed. Because these wells would be installed generally in previously disturbed areas, impacts on vegetation and wildlife habitat and biota from periodic groundwater sampling would be minor and localized. No adverse impacts on aquatic and wetland habitats and biota are expected. If a monitoring well were required in an area in which the exemption process would be applied, BMPs, mitigation measures and impact avoidance and minimization measures would be implemented to avoid or minimize adverse impacts of well installation and monitoring on threatened, endangered, or rare species; no adverse impacts on these species are expected from monitoring activities outside the areas in which the exemption process would be applied.	Impacts on vegetation and wildlife habitat and biota would be larger than those under the Groundwater Monitored Natural Attenuation Alternative, but nonetheless localized and minor. Installation of groundwater treatment systems would generally be in previously disturbed habitats, with localized and minor impacts. Assuming sandstone bedrock containing strontium-90 source is removed, up to 0.25 acre of habitat near RMHF would be affected. No adverse impacts are expected on aquatic and wetland habitats and biota. Potential impacts on threatened, endangered, or rare species would be minimal with application of, BMPs, mitigation measures and impact avoidance and minimization measures as described under the Groundwater Monitored Natural Attenuation Alternative.
Air quality and climate	No emissions of airborne pollutants, including greenhouse gases, above baseline conditions are expected.	Minor quantities of pollutants such as VOCs, CO, NOx, SO_2, and particulates would be emitted during monitoring well installation and groundwater monitoring, and from on-road vehicles. Minimal emissions of CO_2 are expected.	Small quantities of VOCs, CO, NOx, SO_2, and particulates would be emitted during bedrock removal, soil backfilling, and treatment system installation. Additional emissions would occur from on-road vehicles. A total of 500 to 1,700 metric tons of CO_2 would be emitted, primarily from vehicles.

Resource Area	Alternatives		
	Groundwater No Action	***Groundwater Monitored Natural Attenuation***	***Groundwater Treatment***
Noise	No noise impacts above baseline conditions from onsite activities or from traffic to and from SSFL are expected.	Noise levels at the closest residence could increase slightly compared to those under the Groundwater No Action Alternative, but are still expected to be well below 65 dBA CNEL, with no adverse noise impacts. There could be a few heavy-duty truck round trips distributed over a working year, with no expected adverse traffic-related noise impacts.	Noise levels from onsite activities at the closest residence could slightly increase compared to those under the Groundwater Monitored Natural Attenuation Alternative, but are still expected to be well below 65 dBA CNEL, with no adverse noise impacts (i.e., incremental noise increases would be below the threshold of 5 dBA CNEL). Heavy-duty truck traffic would include approximately 530 shipments of excavated bedrock and backfill as well as a few deliveries of equipment, which are not expected to result in adverse noise impacts along the evaluated routes between SSFL and major highways.
Transportation [a]	No impacts above baseline conditions are expected.	**Shipment of nonhazardous waste, equipment, and supplies** [a, b] Shipments – 620 shipments by truck. Traffic fatality accident risks – 0 (3.1×10^{-4})	**Shipment of radioactive waste – truck option** [a] Shipments – 340 truck shipments *Incident-free risks:* - Crew LCFs: 0 (2×10^{-5} to 6×10^{-5}) - Population LCFs: 0 (5×10^{-6} to 2×10^{-5}) *Accident risks:* - Population LCFs: 0 (1×10^{-11} to 3×10^{-10}) - Traffic fatalities: 0 (2×10^{-3} to 3×10^{-3}) **Shipment of radioactive waste – truck/rail option** [a] Shipments – 340 truck shipments from SSFL to an intermodal facility, then 30 rail shipments *Incident-free risks:* - Crew LCFs: 0 (8×10^{-6} to 1×10^{-5}) - Population LCFs: 0 (7×10^{-6} to 1×10^{-5}) *Accident risks:* - Population LCFs: 0 (2×10^{-11}) - Traffic fatalities: 0 (6×10^{-3} to 2×10^{-2}) **Shipment of nonradioactive waste, backfill, equipment, and supplies** [a] *Truck option:* - 320 truck shipments - Traffic fatality risks: 0 (3.9×10^{-3}) *Truck/rail option:* - Not applicable. All shipments are by truck.

Resource Area	Alternatives		
	Groundwater No Action	***Groundwater Monitored Natural Attenuation***	***Groundwater Treatment***
Traffic	No increases in average daily traffic or LOS on roads in the SSFL vicinity are expected, with no traffic-induced damage to road pavement.	The weekday average daily traffic on Woolsey Canyon Road would increase by 0.10 percent above baseline conditions during 1 year. Traffic increases on other roads or during other years when shipments would occur would be smaller. Although there would be only a small annual number of truck shipments and other traffic associated with this alternative, with only one annual truck shipment during most years evaluated under this alternative, these small numbers of shipments would occur in a heavily trafficked area. During the peak year of shipment of waste, equipment, and supplies, the AM LOS for the intersection of Woolsey Canyon Road with Valley Circle Boulevard would be operating at an E level. Assuming the continuation of well water sampling for up to two decades, these truck shipments and worker commutes would occur during years having increasing traffic congestion, with this and other intersections operating at an E or F rating during AM or PM traffic conditions. No routes would experience significant increases in ESALs, with little or no damage to road pavement.	The weekday average daily traffic on Woolsey Canyon Road would increase by 0.80 percent above baseline conditions during 1 year. Traffic increases on other roads or during other years when shipments would occur would be smaller. Truck shipments under this alternative would be small but larger than those under the Groundwater Monitored Natural Attenuation Alternative. Nonetheless, these small numbers of shipments would occur in a heavily trafficked area. For example, during peak year of shipment of waste, equipment, and supplies, the LOS rating for the intersection of Woolsey Canyon Road with Valley Circle Boulevard would be operating at an E rating during AM peak traffic conditions. This would also be the case for the other years required to implement this alternative, during which time the LOS rating for this intersection would operate during peak AM traffic conditions at an E or F rating. Traffic would impose about 1,700 ESALs on the evaluated roads, with minimal potential for damage to road pavement.

Resource Area	Alternatives		
	Groundwater No Action	***Groundwater Monitored Natural Attenuation***	***Groundwater Treatment***
Human health	**Worker** There would be minimal impacts on workers solely attributable to continuation of the current groundwater monitoring program.	**Worker** Same as the Groundwater No Action Alternative.	**Worker** Workers would receive a radiation dose from excavation of contaminated bedrock. *Individual worker* - Dose: 36 millirem - Cancer incidence risk: 2.8×10^{-5} (1 in 36,000) Workers would be protected from industrial hazards and radiation exposure through compliance with DOE requirements for worker safety and radiation protection.
	Members of the public No impacts on a hypothetical future onsite or offsite suburban resident or recreational user are expected because there is not a sustainable water supply in Area IV and NBZ sufficient for prolonged household use, particularly by multiple households. Well water use by a recreational user is not expected. Considering the slow movement of Area IV groundwater and the concentrations of chemicals and radionuclides, no impacts on offsite members of the public are expected because groundwater migration is not expected to reach offsite receptors prior to decay below screening levels.	**Members of the public** Same as the Groundwater No Action Alternative.	**Members of the public** *Onsite Residents and Recreators* – Same as the Groundwater No Action Alternative. *Offsite Resident and Recreators* – The impacts on the offsite resident and recreator receptors from groundwater remediation (bedrock removal) activities are 4 to 6 orders of magnitude less than all thresholds for impact comparison, which is considered insignificant impact. <u>Resident:</u> - Radiological risk: 5.0×10^{-10} - Radiological Dose: 6.8×10^{-4} millirem <u>Recreator:</u> - Radiological risk: 2.3×10^{-10} - Radiological Dose: 2.9×10^{-4} millirem
Waste management	No impacts are expected on the capacity of the permitted wastewater treatment plant that would receive approximately 200 gallons of purge water annually from Area IV.	Nonhazardous waste – 10 cubic yards Well development water – 500 gallons Monitoring purge water – 200 gallons/year No exceedance of total waste capacity or a daily or annual waste acceptance limit is expected at any evaluated facility.	LLW/MLLW – 4,500 cubic yards [c] Hazardous waste – 13 cubic yards [c] No exceedance of total waste capacity or a daily or annual waste acceptance limit is expected at any evaluated facility.

Resource Area	Alternatives		
	Groundwater No Action	***Groundwater Monitored Natural Attenuation***	***Groundwater Treatment***
Cultural resources	***Architectural Resources.*** No historic properties would be affected. ***Archaeological Resources***. No historic properties would be affected. ***Traditional Cultural Resources***. No adverse impacts are expected.	***Architectural Resources.*** No historic properties would be affected. ***Archaeological Resources***. No adverse impacts are expected because installation of equipment would avoid identified archaeological sites, and there is low likelihood of unanticipated discoveries during installation of equipment. ***Traditional Cultural Resources***. Aboveground elements would be designed to avoid adverse effects on the landscape.	***Architectural Resources.*** Same as the Groundwater Monitored Natural Attenuation Alternative. ***Archaeological Resources***. Same as the Groundwater Monitored Natural Attenuation Alternative. ***Traditional Cultural Resources***. Same as the Groundwater Monitored Natural Attenuation Alternative.
Socioeconomics	No socioeconomic impacts on employment, regional truck traffic, infrastructure and municipal services, housing, and local government revenue are expected in Los Angeles and Ventura Counties. No socioeconomic impacts on businesses in the vicinities of the offsite waste management facilities are expected.	Minimal beneficial socioeconomic impacts from worker employment and purchases of equipment and supplies. There would be no socioeconomic impacts on businesses in the SSFL vicinity and little or no damage to pavement from additional traffic that could increase expenses for local governments.	Minimal beneficial socioeconomic impacts from worker employment and purchases of equipment and supplies. There would be no socioeconomic impacts on businesses in the SSFL vicinity and minimal damage to pavement from additional traffic that could increase expenses for local governments.
Environmental justice	No impacts on the health of members of the public are expected. There would be no increases in traffic above baseline conditions in the SSFL and regional ROIs, and thus, no additional traffic-related impacts. No disproportionate impacts on minority or low-income populations, including Native American tribes are expected in the SSFL ROI or regional ROIs.	- No impacts on the health of members of the public are expected. Therefore, no disproportionately high and adverse impacts on minority or low-income populations, including Native American tribes, in the SSFL ROI are expected. - Because the increase in average daily traffic on the evaluated roads in the SSFL vicinity is very small (much less than 1 percent), no traffic impacts are expected. No disproportionately high and adverse impacts on minority or low-income populations, including Native American tribes, in the SSFL ROI are expected. - There would be no noticeable increase in truck traffic in the vicinity of any facility receiving waste under this alternative, with no expected traffic impacts. No disproportionately high and adverse impacts on minority or low-income populations, including Native American tribes, in the regional ROIs are expected.	- No impacts on the health of members of the public are expected. Therefore, no disproportionately high and adverse impacts are expected on minority or low-income populations, including Native American tribes, in the SSFL ROI are expected. - The increase in average daily traffic on the evaluated roads in the SSFL vicinity would be greater during 1 year than that under the Groundwater Monitored Natural Attenuation Alternative, but the peak-year increase would still average less than 1 percent, with no expected traffic impacts. Therefore, no disproportionately high and adverse impacts on minority or low-income populations, including Native American tribes, in the SSFL ROI. - Shipments of waste under this alternative would primarily consist of excavated bedrock delivered to radioactive waste facilities. No noticeable increase in traffic is expected in the ROI of any evaluated facility, with no expected traffic-related impacts. No disproportionately high and adverse impacts are expected on minority or low-income populations, including Native American tribes, in the regional ROIs.

Resource Area	Alternatives		
	Groundwater No Action	***Groundwater Monitored Natural Attenuation***	***Groundwater Treatment***
Sensitive-aged populations	There would be no increases in traffic above baseline conditions in the SSFL ROI and the regional ROIs, and thus, no additional traffic-related impacts. No disparate impacts (markedly distinct impacts relative to those on the general population) on sensitive-aged populations are expected.	- Because the increase in average daily traffic on the evaluated roads is very small (much less than 1 percent), no disparate impacts are expected on sensitive-aged populations in the SSFL ROI. - There would be no noticeable increase in truck traffic in the vicinities of disposal facilities, with no disparate impacts expected on sensitive-aged populations in the regional ROIs.	- The increase in average daily traffic on the evaluated roads would be slightly greater than that under the Groundwater Monitored Natural Attenuation Alternative, but the peak-year increase in average daily traffic would still be less than 1 percent. No disparate impacts are expected on sensitive-aged populations in the SSFL ROI. - There would be no noticeable increase in truck traffic in the vicinity of any facility receiving waste under this alternative, with no disparate impacts expected on sensitive-aged populations in the regional ROIs.

AOC = *Administrative Order on Consent for Remediation*; BMP = best management practice; CO = carbon monoxide; CO_2 = carbon dioxide; CMWD = Calleguas Municipal Water District; CNEL = community noise equivalent level; dBA = decibels A-weighted; ESAL = equivalent single axle load; LCF = latent cancer fatality; LLW = low-level radioactive waste; LOS = level of service; LUT = Lookup Table; MLLW = mixed low-level radioactive waste; NBZ = Northern Buffer Zone; NOx = nitrogen oxides; RMHF = Radioactive Materials Handling Facility; ROI = region of influence; SO_2 = sulfur dioxide; VOC = volatile organic compound.

[a] Transportation risks are presented as whole numbers with the actual calculated values presented in parentheses. Values in parentheses that have a negative power of 10 are less than 1. The larger the negative value of 10, the smaller the number.

[b] Wastes generated under the Groundwater Monitored Natural Attenuation Alternative consist of very small quantities of cuttings from monitoring well installation and water from well installation and sampling that are shipped by truck only. These wastes are not expected to be classified as low-level or mixed low-level radioactive waste, but if determined otherwise when generated, would be safely transported to appropriate authorized or permitted facilities for disposition.

[c] These volumes reflect conservative estimates of waste generation considering the range of groundwater treatment technologies that may be implemented in the future.

S.11.2 Potential Environmental Consequences of Combined Action Alternatives

This section addresses potential impacts for each resource area, assuming (1) implementation of eight possible combinations of action alternatives, as summarized in the text box below, and (2) each combination includes *one* soil remediation action alternative, *one* building demolition action alternative, and *one* groundwater remediation action alternative (also see below).

Action Alternative Combination	Designation
Cleanup to AOC LUT Values + Building Removal + Groundwater Monitored Natural Attenuation	–
Cleanup to AOC LUT Values + Building Removal + Groundwater Treatment	Action Alternative Combination with the Largest Environmental Consequences (High Impact Combination)
Cleanup to Revised LUT Values + Building Removal + Groundwater Monitored Natural Attenuation	–
Cleanup to Revised LUT Values + Building Removal + Groundwater Treatment	–
Conservation of Natural Resources (Residential Scenario) + Building Removal + Groundwater Monitored Natural Attenuation	–
Conservation of Natural Resources (Residential Scenario) + Building Removal + Groundwater Treatment	–
Conservation of Natural Resources (Open Space Scenario) + Building Removal + Groundwater Monitored Natural Attenuation	Action Alternative Combination with the Smallest Environmental Consequences (Low Impact Combination)
Conservation of Natural Resources (Open Space Scenario) + Building Removal + Groundwater Treatment	–

AOC = *Administrative Order on Consent for Remedial Action*; LUT = Look-Up Table.

For most resource areas, the largest potential impacts arise from the combination of the Cleanup to AOC LUT Values, Building Removal, and Groundwater Treatment Alternatives. This combination of action alternatives is termed the "High Impact Combination." Conversely, for most resource areas, the smallest impacts arise from the combination of the Conservation of Natural Resources (Open Space Scenario), Building Removal, and Groundwater Monitored Natural Attenuation Alternatives. This combination of action alternatives is termed the "Low Impact Combination." For those resource areas where the impacts are not necessarily encompassed by these combinations of action alternatives, the applicable combination is specified and evaluated.

The groundwater treatment technologies to be implemented would be determined by means of a RCRA Corrective Measures Study (see Chapter 2, Section 2.6), which is yet to be finalized. Therefore, this EIS evaluates the potential impacts that could occur assuming implementation of those technologies that would result in the largest potential impacts. In addition, DOE could decide to implement elements of both groundwater remediation action alternatives. In this event, the potential impacts for some resource areas could be slightly larger than those under the High Impact Combination.

Land resources.

Land use. No combination of action alternatives would cause a change in land use designation. The High Impact Combination would be the least consistent with Boeing's conservation easements because of the large land areas that would be disturbed. The Low Impact Combination would be the most consistent with the conservation easements because soil presenting unacceptable risks would be removed with a minimum of disturbance to the existing habitat.

Recreation. Under both the High Impact and Low Impact Combinations, motorists could experience or perceive delays using Woolsey Canyon Road to access Sage Ranch Park, which could reduce its weekday use. Increased traffic would occur for about seven times as many years under the High Impact Combination as under the Low Impact Combination. Except for Woolsey Canyon Road, traffic on any road that may pass a recreational area in the SSFL vicinity could be reduced by distributing truck traffic among the four routes between SSFL and major highways.

Infrastructure. Annual electrical use would be minimal under all action alternative combinations.

CMWD is the expected source for water for remediation activities such as dust suppression. About 46 million gallons of water would be used under the High Impact Combination. If both groundwater remediation action alternatives were implemented, both the maximum annual and total water use would increase by about 5,000 gallons. About 4.1 million gallons of water would be used under the Low Impact Combination. The maximum annual water use under either combination would be about 1.9 million gallons.

Water use is an important consideration because of the drought in Southern California, which culminated in measures to significantly reduce water consumption. Water use could be potentially reduced by using surfactants or other measures to assist in dust control.

*Aesthetics and visual quality***.** Over all action alternative combinations, onsite views at Area IV and the NBZ would be temporarily degraded. In the long term, stabilization and revegetation would introduce surface texture and color in areas previously barren areas and improve aesthetics and visual quality.

Geology and soils. About 3,000 cubic yards of bedrock would be excavated under action alternative combinations that include the Groundwater Treatment Alternative (such as the High Impact Combination), with minimal impacts on bedrock geologic resources.

Although soil excavation from the Santa Susana Formation could impact paleontological resources (i.e., fossils), the formation is mostly located within areas where the exemption process would be applied Potential impacts would likely be largest under High Impact Combination and smallest under the Low Impact Combination.

There could be risks to workers removing soil within zones where earthquake-induced landslides could occur. Risks would be largest under the High Impact Combination and smallest under the Low Impact Combination (because of the lesser extent of soil remediation). DOE would implement the 2010 AOC (DTSC 2010a) exemption process if it was determined that excavating soil in these areas would present unacceptable risks. Potential risks due to seismic shaking to workers performing building demolition would be the same under all action alternative combinations.

Up to 99 acres of land could be disturbed under the High Impact Combination or about 17 acres under the Low Impact Combination. Although impacts from soil erosion would be minimized using BMPs, rainstorms could result in soil loss due to erosion, leading to a reduction of soil quality and functional capability within the eroded areas.

About 677,000 cubic yards of backfill would be required under the High Impact Combination or about 42,000 cubic yards under the Low Impact Combination. The quality of this backfill for biological

activity, filtration, and vegetation support may be less than current soil at Area IV and the NBZ; the backfill could then be less able to support vegetation similar to that present before development of Area IV. Sources for backfill, containing chemical and radioactive constituents in concentrations meeting AOC LUT values have not been found. On December 21, 2016, DOE sent a letter to DTSC describing DOE's efforts and difficulty in locating backfill soil that meets the 2010 AOC requirements and requesting initiation of the consultation process (DOE 2016). Allowable concentrations of chemical constituents in backfill under the Low Impact Combination would be determined from risk assessments and would generally be higher than AOC LUT values, so that finding acceptable sources of backfill may be more likely.

Surface water resources. The High Impact Combination would have the largest area of disturbance (about 99 acres) and the greatest potential for impacts on surface water due to erosion that could increase sediment levels in runoff. The Low Impact Combination would have the smallest potential for impacts on surface water because it would have the least soil disturbance (about 17 acres). Implementing any action alternative combination would potentially result in a long-term improvement in surface water resources at Area IV and its vicinity because a potential source of surface water contamination would be removed.

DOE would implement BMPs and minimization measures to filter sediments and other contaminants from surface water runoff and to limit increases in runoff velocity and volume. Except possibly for scenarios where an unusually large rainstorm occurs between soil excavation and revegetation of disturbed areas, coupled with exceedance of the stormwater control system capacity, no impacts are expected on surface water quality on site or in regional waterways or on stormwater control system capacities in downstream regional waterways. These potential impacts may be mitigated by implementing Mitigation Measures SW-1 and SW-2 (see Chapter 6, Table 6-2).

Groundwater resources. The High Impact Combination would have the largest positive impacts on groundwater quality in the shortest time, with the positive impacts primarily resulting from the Groundwater Treatment Alternative. Although the Building Removal Alternative would be considered under all action alternative combinations, Area IV buildings are not a source of chemicals or radionuclides to groundwater. Positive impacts would differ little among the soil remediation action alternatives because the most highly impacted soil was previously removed. The remaining soil contaminants may not be mobile due to their chemical and physical properties. There would be no adverse impacts on groundwater from soil removal. The Low Impact Combination would have a comparable positive impact on groundwater quality, but this positive impact would be achieved over a much longer time if only monitored natural attenuation was implemented.

Biological resources. The High Impact Combination would have the largest impacts. Vegetation and wildlife habitat would be removed from about 99 acres of land, including about 33 acres of relatively undisturbed native habitat composed of coast live oak woodland, northern mixed chaparral, and Venturan coastal scrub. The affected areas would be profoundly disturbed and would require substantial, focused, and prolonged efforts revegetate and restore habitat.

Building removal would occur in previously disturbed habitats with low to moderate. If listed species such as Santa Susana tarplant are found in proximity to buildings, direct impacts could be minimized by surveys and possible avoidance. Unavoidable impacts on individual tarplants could be mitigated by salvage of seed, propagation, and replanting following demolition.

The Groundwater Treatment Alternative would disturb less than an acre through the assumed emplacement and operation of treatment units and excavation of bedrock. Impacts on threatened, endangered, or rare species would likely be avoidable due to the localized nature of the activities, the small areas affected, and the proximity of well sites to existing access roads and disturbed areas.

Implementing both groundwater remediation action alternatives would cause very little incremental surface disturbance from installation of additional wells.

The Low Impact Combination would affect approximately 17 acres and have the smallest impacts. The Conservation of Natural Resources Alternative, Open Space Option, would remove vegetation and wildlife habitat from about 9 acres. The Conservation of Natural Resources Alternative, either scenario, would have far fewer impacts on vegetation and wildlife habitat and biota, wetland and aquatic habitats and biota, and endangered, threatened, or rare species than the Cleanup to AOC LUT Values Alternative.

Air quality and climate. The air quality analysis evaluated four combinations of action alternatives that would result in the highest potential impacts from emissions of volatile organic compounds, carbon monoxide, carbon dioxide, sulfur oxides, nitrogen oxides, and particulates (PM_{10} and $PM_{2.5}$). Each combination consists of one of the soil remediation action alternatives/scenarios, the Building Removal Alternative, and the Groundwater Treatment Alternative. Emissions under the Groundwater Monitored Natural Attenuation Alternative were not calculated. Emissions would be slightly smaller if the Groundwater Monitored Natural Attenuation Alternative were implemented and slightly larger if both groundwater remediation action alternatives were implemented.

Projected emissions were evaluated relative to air quality conditions within three air domains: Ventura County and the area directly adjacent to SSFL, which are within the South Central Coast Air Basin; South Coast Air Basin, which includes portions of Los Angeles County; and regions beyond Ventura County and the South Coast Air Basin.

Peak annual emissions were compared to annual indicator emission thresholds for the three domains and peak daily emissions were used to indicate the potential for an action alternative combination to contribute to an exceedance of an ambient air quality standard. Emissions were determined for remediation of Area IV and the NBZ, and for truck transport of soil, waste, recycle material, backfill, and equipment. Emissions from truck transport of soil, waste, and recycle material were determined assuming shipment to nearby or distant disposal sites. Peak emissions are estimated for a year when soil removal under any of the soil remediation action alternatives overlaps with building removal.

Ventura County. A small range in peak annual emissions would occur within Ventura County across the four groups of combined action alternatives. Peak annual emissions would occur in the year in which the last year of building removal is assumed to overlap with activities associated with the first year of soil remediation. Annual combustive emissions would decrease each subsequent year due to replacement of older and higher-emitting vehicles with newer vehicles that comply with more-stringent emission standards. Peak annual emissions of PM_{10} and $PM_{2.5}$ would occur under the Conservation of Natural Resources Alternative, Recreational Scenario combined with the Building Removal Alternative. Although for most pollutants the largest contributors to combustive emissions would be off-road construction equipment, most PM_{10} and $PM_{2.5}$ emissions would be associated with fugitive dust from operation of equipment and trucks on unpaved and paved surfaces. Each of the action alternatives combinations would produce the same amount of peak daily emissions because it was assumed that the maximum number of daily truck trips (32) would occur under any alternative combination.

It was assumed that DOE would implement measures to reduce fugitive PM_{10} and $PM_{2.5}$ emissions by 74 and 50 percent, respectively, from uncontrolled levels and DOE would comply with Ventura County Air Pollution Control District (VCAPCD) Rule 55 (Fugitive Dust), which restricts emissions of fugitive dust from being visible beyond the property line of a source. These controls and restrictions would ensure that emissions of fugitive dust would not contribute to an exceedance of a PM_{10} ambient air quality standard at any offsite location.

Low to moderate levels of combustive emissions such as carbon monoxide (up to 62 pounds per day) and nitrogen oxides (up to 81 pounds per day) would be generated intermittently from mobile equipment and trucks operating in Area IV. These emissions would be diluted in the atmosphere to the point of causing minimal impacts outside of SSFL and would not contribute to an exceedance of an ambient air quality standard within Ventura County. Similarly, there would be minimal impacts from hazardous air pollutants and toxic air contaminants, including diesel particulate matter from equipment and haul trucks.

The impact of air emissions to sensitive members of the population is a concern. The above analyses demonstrate that combustive and fugitive dust emissions from DOE's remediation would cause minimal increases in ambient air pollutant levels beyond the SSFL boundary. The nearest sensitive receptors are residences located about 1 mile south-southeast of Area IV. Transport of emissions over one mile or more would further dilute these pollutant concentrations to well below any level of health concern.

South Coast Air Basin. A range in peak annual emissions would occur within the South Coast Air Basin. Peak annual emissions would occur in the year in which the last year of building removal is assumed to overlap with activities associated with the first year of soil remediation. Emissions would occur from worker commuter vehicles and trucks hauling material to offsite disposal facilities and backfill to SSFL.

Except for nitrogen oxides, none of the pollutants would exceed the South Coast Air Basin indicator emission thresholds under a nearby or distant disposal site scenario. Peak annual nitrogen oxides emissions under the nearby disposal site scenario would occur under the Cleanup to AOC LUT Values or Cleanup to Revised LUT Values Alternative combined with the Building Removal Alternative. The Conservation of Natural Resources Alternative, Open Space Scenario, combined with the Building Removal Alternative would generate the smallest amount of annual emissions under the nearby disposal site scenario. Peak annual nitrogen oxides emissions under the distant disposal site scenario would be the same for all combined action alternatives.

Each of the action alternative combinations would result in the same peak daily emissions under a nearby or distant disposal site scenario (the peak day was assumed to generate 32 truck trips). Except for nitrogen oxides, the nearby and the distant disposal site scenarios would result in relatively low daily levels of any evaluated pollutant (less than 15 pounds per day).

Under all action alternatives combinations, the nearby disposal site scenario would generate moderate levels of daily nitrogen oxides emissions (61 pounds per day). Under all combinations, elevated emissions of nitrogen oxides (114 pounds per day) would occur intermittently under the distant disposal site scenario from up to 32 heavy-duty trucks traveling over several hundred miles of roads across the South Coast Air Basin. These emissions would be diluted in the atmosphere to the point of causing minimal impacts and would not contribute to or exacerbate an exceedance of an ambient air quality standard. Similarly, minimal impacts due to hazardous air pollutants and toxic air contaminants (such as diesel particulate matter emissions) would occur within the South Coast Air Basin. Emissions would occur over 160 miles of roads spanning a large portion of the air basin. As a result, populations adjacent to roads used for transport of materials would be exposed to very low levels of these emissions from haul trucks and likely would experience no noticeable health effects.

Many sensitive receptors could exist along roads that haul trucks would use to transport materials through the South Coast Air Basin. The above analyses demonstrate that truck emissions would minimally increase ambient air pollutant levels adjacent to these roads. Therefore, remediation activities would not expose sensitive receptors to any level of air quality that would pose a health concern.

Outside Ventura County and the South Coast Air Basin. Peak annual emissions would occur in the year in which the last year of building removal is assumed to overlap with activities associated with the first year of soil remediation. All emissions outside Ventura County and the South Coast Air Basin would occur from trucks hauling soil and waste to offsite disposal facilities.

None of the evaluated pollutants would exceed indicator emission thresholds in any of the domains outside. Peak annual emissions under a nearby or distant disposal site scenario would occur under the Cleanup to AOC LUT Values or Cleanup to Revised LUT Values Alternative combined with the Building Removal Alternative. The Conservation of Natural Resources Alternative, Open Space Scenario, combined with the Building Removal Alternative would generate the smallest annual emissions under both a nearby and a distant disposal site scenario.

A range in peak daily emissions would similarly occur. Each of the groups of action alternatives combinations would have the same peak daily emissions under a nearby or distant disposal site scenario from a maximum of 32 truck trips per day to the same disposal sites under each scenario. Emissions would be relatively low, except for nitrogen oxides. Under the nearby disposal site scenario, moderate daily levels of nitrogen oxides (about 63 pounds per day) would be emitted. Under the distant disposal site scenario, relatively high daily levels of nitrogen oxides (593 pounds per day) would be emitted intermittently under all action alternatives combinations over hundreds of miles of roads. These emissions would be diluted in the atmosphere to the point of causing minimal impacts and would not contribute to or exacerbate an exceedance of an ambient air quality standard.

Under any of the action alternatives combinations there would be minimal impacts from hazardous air pollutants and toxic air contaminants. Populations adjacent to roads would be exposed to very low levels of hazardous air pollutants and toxic air contaminants from haul trucks and likely would experience no noticeable health effects.

The above analyses demonstrate that truck emissions generated from would minimally increase ambient air pollutant levels adjacent to haul routes. Therefore, transport associated with remediation activities would not expose sensitive receptors outside of Ventura County and the South Coast Air Basin to any level of air quality that would pose a health concern.

Green cleanup. The above analysis was conducted assuming average off-road and on-road vehicle fleets for the years 2019 and 2021. These impacts may be reduced by measures discussed in Chapter 6 of the EIS, such as use of off-road equipment and on-road trucks that meet EPA Nonroad Tier 4 and 2007 EPA Heavy Duty Highway standards, respectively. In the Ventura County domain, implementing the green cleanup fleets identified by DOE as Mitigation Measure AQ-1 (see Chapter 6, Table 6-2) would reduce emissions f of volatile organic compounds, carbon monoxide, nitrogen oxides, and PM_{10} from the average 2021 fleet by about 49 percent for off-road equipment that meets EPA Nonroad Tier 4 emission standards and 66 percent for on-road heavy-duty trucks that are no more than 5 years old. In the South Coast Air Basin and the evaluated domain outside Ventura County and the South Coast Air Basin, emissions from the average year 2021 truck fleet would be reduced by 71 percent as averaged over volatile organic compounds, carbon monoxide, nitrogen oxides, and PM_{10}; and 81 percent for nitrogen oxides.

Climate change. Over the four action alternatives combinations, peak annual emissions of CO_2 would range from about 2,000 to 9,000 metric tons; total emissions of CO_2 would range from about 6,000 to 88,000 metric tons. The maximum total CO_2 emissions (88,000 metric tons) would occur under combination of the Cleanup to AOC LUT Values, Building Removal, and Groundwater Treatment Alternatives. Implementation of mitigation measure AQ-1 (see Chapter 6, Table 6–2) would maximize the use of clean off-road equipment and the newest fleet of haul trucks, which would minimize greenhouse gas emissions from these sources.

Climate change could impact implementation of the alternatives. For SSFL region, analyses predict that the region will experience increased temperatures, droughts, and wildfires, and scarcities of water supplies (California Energy Commission 2012; IPCC 2013; USGCRP 2017). Although current operations at SSFL have adapted to droughts, high temperatures, wildfires, and scarce water supplies, exacerbation of these conditions could impede SSFL remediation. For example, an increase in wildfires could interfere with remediation activities.

Noise. There would be little difference in the intensity of noise emanating from Area IV for any combination of action alternatives. All combinations would require use of heavy equipment with similar noise intensities at the nearest residence, and no expected noise impacts. The High Impact Combination would have the longest noise duration, about 28 years. There would be no change in noise intensity or duration if both groundwater remediation action alternatives were implemented. The Low Impact Combination would have the shortest noise duration. Almost all remediation activities under this combination of action alternatives could be completed in 4 years. After that, there would be very minor traffic noise, primarily due to transport of monitoring well purge water for offsite disposition and monitoring samples to offsite laboratories. For either the High or Low Impact Combination and assuming a peak of 32 daily truck round trips, time-averaged noise levels in residential areas would not be expected to exceed "normally acceptable" levels established for this EIS as defined in the *L.A. CEQA Thresholds Guide* (LA 2006).

Transportation. For incident-free transportation under the High Impact Combination, the maximum radiation risks to truck crews and the population would occur for shipment to Waste Control Specialists (WCS) in Texas, with the risk of a single LCF of 2×10^{-3} (1 chance in 5,000) and 4×10^{-4} (1 chance in 2,500), respectively. Assuming the truck/rail option, the maximum risk of a single LCF to truck/rail crews would occur for shipment to the Nevada National Security Site (NNSS), with a risk of 4×10^{-4} (1 chance in 2,500); and the maximum risks to populations would occur for shipment to WCS in Texas, with a risk of 3×10^{-4} (1 chance in 3,300). The maximum radiological risk of a single LCF from an accident considering reasonably foreseeable accidents from minor to severe, would be negligible (less than 1 in 100 million) for either the truck or truck/rail option. The maximum risk of a traffic accident fatality from radioactive waste transport (due to the mechanical forces and independent of the cargo) would be 1 (calculated value of 0.8), assuming shipment by truck to WCS in Texas.

For incident-free transportation under the Low Impact Combination, the maximum risk of a single LCF to truck crews and the population would occur for shipment to WCS in Texas, with risks of 4×10^{-4} (1 chance in 2,500) and 1×10^{-4} (1 chance in 10,000), respectively. Assuming the truck/rail option, the maximum risk of a single LCF to truck/rail crews would occur for shipment to NNSS (1×10^{-4} or 1 chance in 10,000); and to populations for shipment to WCS in Texas (7×10^{-5} or 1 chance in 15,000). The maximum risk of a single LCF from an accident, considering reasonably foreseeable accidents from the minor to the severe, would be 2×10^{-9} LCF (1 chance in 500 million), assuming all shipments were sent by truck to WCS in Texas or 1×10^{-10} (1 chance in 10 billion) under the truck/rail option to either NNSS or WCS in Texas. The maximum risk of a traffic accident fatality would be 0.2, assuming shipment by truck to WCS in Texas.

The largest risks from transporting nonradioactive material under the truck and truck/rail options would occur under the High Impact Combination. Under the truck option, there would be about 6 (6.4) accidents and 0 (0.26) traffic fatalities. If both groundwater remediation action alternatives were implemented, there would be no substantial change in risk. Under the truck/rail option, there would be about 10 accidents and 2 (2.3) fatalities. The smallest risks would occur under the Low Impact Combination. The number of accidents and fatalities from transporting nonradioactive waste

and material by truck would be 1 (0.65) and 0 (0.028), respectively, under the truck option and 1 (0.66 and 0 (0.13), respectively, under the truck/rail option.

Traffic. Under the High Impact Combination, there would be about 104,000 heavy-duty truck round trips, including truck shipments of backfill, equipment, and supplies about 201,000 round trips of cars or light-duty trucks, primarily for worker commutes. The largest increase in weekday traffic volume would occur on Woolsey Canyon Road, where over 28 years, the average daily traffic would increase by 4.1 to 8.6 percent above baseline conditions during the first 4 years and up to 3.3 percent the remaining years (see Appendix H, Table H–23). Weekday motorists on Woolsey Canyon Road could experience or perceive delays compared to baseline conditions; there could also be delays or perceived delays at the intersection of Woolsey Canyon Road with Valley Circle Boulevard. These delays or perceived delays would be similar to those under the Cleanup to AOC LUT Values Alternative, but would last for 28 years rather than 26 years. If both groundwater remediation action alternatives were implemented, the total number of heavy- and medium-duty truck round trips would increase by about 58 round trips with no noticeable increase in traffic volumes.

The LOS rating of Woolsey Canyon Road could change from an A rating to a B rating during AM peak traffic conditions. Traffic growth in the SSFL area could result in increased traffic congestion, with some intersections operating at an E or F rating during AM or PM peak traffic conditions. For example, the intersection of Woolsey Canyon Road with Valley Circle Boulevard would operate at an F rating during AM peak traffic conditions during most of the 26 years of soil removal. Congestion at this intersection may be mitigated through installation of traffic signals.

Under the Low Impact Combination, there would be about 6,900 heavy-duty truck round trips, including truck shipments of backfill, equipment, and supplies. In addition, there would be about 51,000 round trips of cars and light-duty trucks, primarily from worker commutes. The largest increase in weekday traffic would occur on Woolsey Canyon Road, where the average daily traffic would increase by about 2.2 to 8.6 percent above baseline conditions during the first 4 years of project activities, and by about 0.05 percent during the remaining years (see Appendix H, Table H–23). Similar to the High Impact Combination, there could be delays or perceived traffic delays for motorists on Woolsey Canyon Road or its intersection with Valley Circle Boulevard. However, the most of the heavy-duty truck shipments would be competed in 4 years.

The LOS rating of Woolsey Canyon Road could change from an A rating to a B rating during AM peak traffic conditions. Traffic growth in the SSFL area could result in increased traffic congestion, with some intersections operating at an E or F rating during AM or PM peak traffic conditions. But fewer intersections in the SSFL area could have LOS ratings of E or F at the end of the 4-year period for the Low Impact Combination than would be the case for the 28 years required for the High Impact Combination. During these 4 years, the intersection of Woolsey Canyon Road with Valley Circle Boulevard could operate at an E LOS rating during AM peak traffic conditions. Congestion at this intersection may be mitigated through installation of traffic signals.

Traffic under the High or Low Impact Combinations would impose about 226,000 or 15,000 ESALs, respectively, on the routes between SSFL and major highways. Some of the roads already need repair, and increased vehicle traffic could further damage the roads, causing them to need repairs sooner than currently anticipated.

Heavy-duty trucks making a sharp right turn from Woolsey Canyon Road onto Valley Circle Boulevard may need to pull partially into an adjacent lane, resulting in a risk of incidents with oncoming traffic. This risk may be mitigated by measures such as installation of a traffic signal at the intersection or posting of a flag person when shipments are made from Area IV.

Human health. Following remediation of Area IV and the NBZ, the principal risk would be residual chemical and radioactive constituents in soil. The impacts on an onsite suburban resident or recreational user following any of the soil action alternatives would be smaller than those under the No Action Alternative; the impacts would be similar for all of the action alternatives although there would be some variation. The High Impact Combination, under which the most soil would be removed from the site, would have the a residual cancer risk of 4×10^{-7} to 5×10^{-5} and toxic chemical hazard index range of 0.05 to 0.9 (based on 19 risk assessment units evaluated) to a residential receptor. The Low Impact Combination would have a residual cancer risk of 3×10^{-7} to 1×10^{-5} and a toxic chemical hazard index range of 0.01 to 0.3 for a recreational user.

Offsite receptors would have a combined impact from each of the alternative groups. Potential offsite impacts from the soil remediation alternatives and the strontium-90 removal activity are orders of magnitude less than those for the Building Removal Alternative. Combined lifetime cancer risks to an offsite resident and offsite recreational user would be 1.0×10^{-7} and 8.4×10^{-9}, respectively.

Implementing different combinations of action alternatives would have little effect on the maximum number of workers on site in a year, but would have a large effect on the number of years that workers could be exposed to chemical and industrial hazards. Under the High Impact Combination, workers would be subject to hazards over a 28-year period, while under the Low Impact Combination; workers would be subject to hazards over a 4-year period. In addition, there could be a combined radiological impact on workers involved in both building demolition (D&D workers) and soil or groundwater remediation (remediation workers). The impacts on remediation workers are judged to be significantly less than those for D&D workers; therefore, the combined radiological impacts would not be significantly larger than those for D&D workers alone.

Regardless of the combination of action alternatives, workers would be protected in accordance with DOE regulations (e.g., 10 CFR Parts 835 and 851) and DOE Orders. Worker protection practices would be employed so that doses are maintained as low as reasonably achievable below DOE occupational exposure limits.

Waste management. Over all combinations of action alternatives, the total LLW/MLLW volume would be up to 125,000 cubic yards, which would not impact the disposal capacity at any of the evaluated facilities. Under the truck option, there would be about 1,000 to 8,500 shipments over 3 to 6 years, depending on the action alternatives combination. The average daily number of deliveries would range from about 2 to 13 under the High Impact Combination and about 2 under the Low Impact Combination. Under the truck option and assuming all waste was delivered to a single facility, there would be the same number of daily shipments arriving at that facility. Except for NNSS (which does not have rail access), there would be reduced daily deliveries to the LLW/MLLW facilities under the truck/rail option.

The total hazardous waste volume (about 2,100 cubic yards for all action alternative combinations) would not impact the total disposal capacity at any hazardous waste facility. There would be about 140 to 260 truck shipments over 3 to 7 years, depending on the combination of action alternatives, with an average daily number of deliveries of less than 1. Under the truck option, there would be the same number of daily deliveries to any single facility. Under the truck/rail option, there would be reduced daily deliveries to US Ecology in Idaho. The projected deliveries would not impact any daily or yearly receipt limit, if applicable, at any of the facilities.

The total nonhazardous waste (to include moderate-risk and non-waste soil) volume would range from 770,000 cubic yards under the High Impact Combination to 37,200 cubic yards under the Low Impact Combination. The high end of the range would represent about 33 percent of the capacity being constructed or planned at the McKittrick Waste Treatment Site in California (assuming all waste was

sent to that site). There would be about 50,300 truck shipments over 28 years under the High Impact Combination or 2,500 shipments over 4 years under the Low Impact Combination. The average number of daily deliveries would range from less than 1 to about 9 under both combinations. Only transport to the Mesquite Regional Landfill in California was evaluated for the truck/rail option. Projected deliveries would not exceed any annual or daily receipt limit at any of the facilities.

About 3,540 cubic yards of recycle material would be delivered to offsite recycle facilities over about 2 to 3 years under all combinations of action alternatives. There would be less than one shipment per day on average. No impacts on recycle capacity are expected.

Cultural resources.

Archaeological and Architectural Cultural Resources. There are no structures (architectural resources) in the APE that are listed or eligible for listing on the NRHP or the California Register; therefore, no historic properties related to architectural resources would be affected under any combination of action alternatives, and no impacts on this resource class have been determined under NEPA.

For archaeological resources, consistent with the 2010 AOC (DTSC 2010a), DOE has identified locations of known archaeological sites as areas in which the exemption process would be applied. In the soil remediation plan that DOE would submit for DTSC approval, DOE would propose that areas subject to the exemption process be cleaned of chemical and radioactive constituents if they pose a risk to human health or the environment. At this time, DOE risk assessments have identified soils that would need to be remediated that are on or near some archaeological sites. Therefore, some archaeological sites may be impacted by cleanup activities under any of the soil remediation action alternatives. In accordance with the Section 106 Programmatic Agreement currently under development, DOE will prepare one or more Historic Properties Treatment Plan(s). The plan(s) will document which historic properties will be avoided, if any; describe the scope of the adverse effects on historic properties that cannot be avoided; and, as appropriate, include measures to minimize and mitigate such adverse effects, the manner in which these measures will be carried out, and a schedule for their implementation. The overall potential adverse effects related to archaeological resources would be similar but would vary somewhat among the alternatives, depending on extent of cleanup. Under all alternatives, in the unlikely event that an unanticipated archaeological resource is encountered, DOE will comply with applicable regulations and the Section 106 Programmatic Agreement currently under development, which will include procedures for the discovery and treatment of unanticipated archaeological finds.

The High Impact Combination would have the greatest potential to encounter unanticipated archaeological resources, primarily because this combination includes the Cleanup to AOC LUT Values Alternative, which would cause the largest soil disturbance of any of the soil remediation action alternatives. The Building Removal Alternative would be unlikely to encounter unanticipated archaeological resources based on the prior disturbance associated with facility construction. Similarly, it is unlikely that the groundwater remediation action alternatives, implemented together or separately, would encounter unanticipated archaeological resources during installation of equipment.

The Low Impact Combination would have the least potential to encounter unanticipated archaeological resources, primarily because this combination includes the Conservation of Natural Resources Alternative, Open Space Scenario, which would cause the least soil disturbance of any of the soil remediation action alternatives. As discussed above, the Building Removal Alternative and both groundwater remediation action alternatives would be unlikely to encounter unanticipated archaeological resources.

Traditional Cultural Resources. The High Impact Combination would have the greatest potential to impact traditional cultural resources, primarily because this combination would have the most landscape alteration and longest cleanup duration. Removal of built structures under the Building Removal Alternative could be considered beneficial because potentially intrusive structural elements would be eliminated from the viewscape of traditional structural resources. Groundwater remediation action alternatives, whether implemented together or separately, are unlikely to impact traditional cultural resources in Area IV and the NBZ because aboveground elements would be designed to avoid adverse effects on the landscape.

The Low Impact Combination would have the least potential to impact traditional cultural resources, primarily because this combination includes the Conservation of Natural Resources Alternative, Open Space Scenario, which would have shortest cleanup duration and would result in the least landscape alternation of any of the soil remediation action alternatives. As discussed above, removal of built structures under the Building Removal Alternative could be considered beneficial because potentially intrusive structural elements would be eliminated from the viewscape of traditional cultural resources. Groundwater remediation action alternatives, whether implemented together or separately, are unlikely to impact traditional cultural resources in Area IV and the NBZ because aboveground elements would be designed to avoid adverse effects on the landscape.

Socioeconomics.

Employment. For most years under the High and Low Impact Combinations, the number of onsite workers would range from 25 to 60 workers to demolish buildings and remove soil. Under each combination, however, a few additional workers would be required to undertake tasks under the groundwater remediation action alternatives.

Under any combination of action alternatives, site activities would have a minor beneficial impact on the economy in Los Angeles and Ventura Counties Workers would likely primarily originate from these two counties, however new spending or economic activity in the region would be minimal.

Truck Traffic. The High or Low Impact Combination would result in increased traffic in the SSFL vicinity, with the most noticeable increase occurring on Woolsey Canyon Road. The additional vehicle traffic is not expected to cause socioeconomic impacts on businesses along this road, and traffic on other evaluated roads would increase by lesser amounts. The largest concentration of retail establishments, restaurants, and other businesses is on Topanga Canyon Boulevard. Under either combination, the projected increase in average daily traffic would be too small to have noticeable impacts on businesses along this road.

Infrastructure and Municipal Services. Under any combination of action alternatives, there could be damage to local roads from heavy-duty truck traffic. DOE may need to negotiate with local governments to contribute its portion of the cost for maintenance and repair of affected roads. No impacts on other municipal services are expected.

Housing. Under any combination of action alternative, workers would be primarily employed from Los Angeles and Ventura Counties with no impacts on housing availability.

Local Government Revenue. The High Impact Combination would have the largest adverse and beneficial impacts on local government revenue while the Low Impact Combination would have the smallest. Adverse impacts could result from increased expenses for pavement repair, while beneficial impacts could result from increased revenues from fuel taxes, fees, or other project expenses.

Disposal Facilities. Under the High Impact Combination, LLW and MLLW would be delivered to an assumed single facility at average daily rates ranging from 2 to 13 over 6 years. Under the Low Impact Combination, LLW and MLLW would be delivered to an assumed single facility at an average daily

rate of about 2 over 3 years. This truck traffic is not likely to have socioeconomic impacts on businesses in the vicinities of the facilities, because of the locations of the facilities and the ease of access from major highways. There is almost no difference among the combinations of action alternatives for shipment of hazardous waste. The largest average daily truck deliveries to a single assumed hazardous waste facility would be less than 1, a level of truck traffic would not have socioeconomic impacts on businesses in the vicinities of the disposal facilities.

Under both the High and Low Impact Combinations, the average number of heavy-duty trucks received at a single nonhazardous waste facility could range up to 9 per day, with waste being shipped to disposal facilities over 28 or 4 years, respectively. No or minimal socioeconomic impacts would be expected on businesses in the vicinities of any of the facilities because of the remote locations of the facilities or the ease of access from major highways. Deliveries to an assumed single recycle facility would average less than 1 truck per day, a delivery level which would have no impact on traffic volumes in the vicinities of any of the recycle facilities, and thus no socioeconomic impacts on businesses in the vicinities of these facilities.

Environmental justice.

SSFL ROI. Under any combination of action alternatives, the risks to a member of the public from both the incidence of cancer and a cancer fatality would be dominated by impacts from background levels of chemical and radioactive constituents. Therefore, there would be no disproportionately high and adverse impacts on minority and low-income populations, including Native Americans.

All combinations of action alternatives would increase traffic levels on Woolsey Canyon Road, with much smaller increases on other roads between SSFL and major highways. However, the routes would traverse minority and non-minority communities, as well as low-income and non-low-income communities, and would not pass through Native American lands. Thus, impacts on minority or low-income populations, including Native Americans, would be the same as those experienced by the general population. No disproportionately high and adverse impacts are expected on minority or low-income populations, including Native American tribes, in the SSFL ROI.

Regional ROIs. Regional environmental justice impacts depend on the potential increases in truck traffic on the roads in the vicinities of the offsite facilities. Assuming all deliveries were made to a single LLW/MLLW, hazardous waste, or nonhazardous waste, as appropriate for that facility, the projected frequencies of truck traffic would not result in noticeable increases in traffic levels in the ROIs of those facilities. Therefore, no combination of action alternatives would be expected to have disproportionately high and adverse impacts on minority or low-income populations, including Native American tribes, in the regional ROIs for any of the evaluated recycle and disposal facilities.

Sensitive-aged populations.

SSFL ROI. As discussed in the "Environmental Justice" subsection, all combinations of action alternatives would increase traffic levels on Woolsey Canyon Road, with much smaller increases on other roads between SSFL and major highways. This increased traffic could result in increased risks to pedestrians along or crossing Woolsey Canyon Road, with lesser risks on other SSFL vicinity roads. However, there is not expected to be a significantly larger population of sensitive-aged persons in the group that could experience this risk along Woolsey Canyon Road compared to groups of persons living elsewhere in the SSFL ROI. Traffic volumes on other evaluated routes are not expected to be noticeably larger than those under baseline conditions. In addition, traffic on all roads, other than Woolsey Canyon Road, that pass by or are in the vicinity of schools or recreation areas could be reduced by distributing traffic among the evaluated traffic routes. Under any combination of action

alternatives, therefore, no disparate impacts are expected on sensitive-aged populations in the SSFL ROI.

Regional ROIs. Even if all waste deliveries were made to a single LLW/MLLW or hazardous waste disposal facility, no noticeable increase in traffic would be expected under either the High or Low Impact Combination, with no adverse impacts on the general public. Furthermore, no schools or recreation areas have been identified in the ROIs of the radioactive and hazardous waste facilities. Therefore, no disparate impacts are expected on sensitive-aged populations in the ROIs of these facilities.

Under either combination and assuming all nonhazardous waste was shipped to a single assumed facility, traffic-related impacts would be minimal at the two evaluated facilities with a school or recreation area in their vicinities (Antelope Valley and the McKittrick Waste Treatment Site, both in California).

The number of truck deliveries to any single facility may be reduced if multiple disposal facilities were used or if waste were shipped to one or more rail-accessible facilities. For any combination of action alternatives, therefore, no disparate impacts are expected on sensitive-aged populations in the ROIs for the nonhazardous waste facilities.

S.11.3 Summary of Potential Cumulative Impacts

"Council on Environmental Quality Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act" (40 CFR Parts 1500-1508) define cumulative effects as impacts on the environment that result from the incremental impacts of the proposed action when added to the incremental impacts of other past, present, and reasonably foreseeable future actions, regardless of which agency or person undertakes such other actions (40 CFR 1508.7). Reasonably foreseeable onsite actions at SSFL included in the cumulative impact analysis of this EIS are ongoing and planned demolition, remediation, and waste transportation activities conducted by DOE, NASA, and Boeing. Activities in the SSFL ROI that could contribute to cumulative impacts could include new residential development, new industrial and commercial ventures, resource investigation and development, new utility and infrastructure development, new waste treatment and disposal facilities, and contaminated site remediation. Future actions that are speculative or are not well defined were not analyzed, including the future use of SSFL.

Potential cumulative impacts are summarized in **Table S–10** for each resource area. Chapter 5 presents the detailed cumulative impacts analysis which includes a more detailed discussion of the onsite and offsite activities considered in this cumulative impacts assessment.

Table S–10 Summary of Potential Cumulative Impacts

Resource Area	*DOE Contribution to Cumulative Impacts*	*NASA and Boeing Contribution to Cumulative Impacts*	*Other Contributions to Cumulative Impacts*	*Cumulative Impacts*
Land resources	**Land use:** 17 to 98 acres disturbed; no zoning or land use conflicts. **Recreation:** Increased traffic could discourage weekday use of Sage Ranch Park; no impacts on other recreation areas in the SSFL vicinity are expected. **Infrastructure:** 3,000 to 7,000 gallons per day water consumption for dust suppression. **Aesthetics and visual quality:** Removal of buildings and revegetation would result in beneficial long-term effects on aesthetics and visual quality.	**Land use:** 164 to 265 acres disturbed; no zoning or land use conflicts. Approximately 20 acres of additional undeveloped land in the Southern Buffer Zone could be disturbed if Boeing uses these areas as sources of clean backfill. **Recreation:** Increased traffic could discourage weekday use of Sage Ranch Park; no impacts on other recreation areas in the SSFL vicinity are expected. **Infrastructure:** 210,000 to 214,000 gallons per day water consumption for dust suppression. **Aesthetics and visual quality:** Removal of buildings and revegetation would result in beneficial long-term effects on aesthetics and visual quality.	**Land use:** acreage disturbed not available. **Recreation:** No impacts identified. **Infrastructure:** Annual water use for CMWD averages 177,644 acre feet (or approximately 159 million gallons per day). **Aesthetics and visual quality:** No impacts identified.	**Land use:** 181 to 363 acres disturbed; no zoning or land use conflicts **Recreation:** Increased traffic could discourage weekday use of Sage Ranch Park; no impacts on other recreation areas in the SSFL vicinity are expected. **Infrastructure:** SSFL water use would be approximately 0.1 percent of CMWD's annual supply, but because of regular drought conditions in Southern California, the State of California implemented water use reduction targets in 2018. Therefore, cumulative SSFL water use, although small, may be controversial. **Aesthetics and visual quality:** Removal of buildings and revegetation would result in beneficial long-term effects on aesthetics and visual quality.
Geology and soils	There would be 17 to 98 acres of soil disturbance and loss of soil with mineralogical and biological composition capable of supporting unique vegetation in Area IV and the NBZ. 42,200 to 678,000 cubic yards of backfill would be needed. It is unlikely that a source of backfill meeting the DOE AOC LUT values would have the same physical and chemical properties as existing SSFL soils.	There would be 164 to 265 acres of soil disturbance and loss of soil with mineralogical and biological composition capable of supporting unique vegetation at SSFL. 207,300 to 291,300 cubic yards of backfill would be needed. It is unlikely that an offsite source of backfill meeting the NASA AOC LUT values would have the same physical and chemical properties as existing SSFL soils. Boeing has identified potential borrow areas for backfill in the Southern Buffer Zone. If soil is taken from these borrow areas, an additional 20 acres could be disturbed.	Other construction activities in the region could disturb soils. Although stormwater pollution prevention plan requirements and BMPs would limit soil erosion, some soil erosion is likely. If the soils are similar to those present at SSFL, cumulative impacts on these soil types could result. Other construction activities in the region could require soils for backfill, but are just as likely to result in excess soil from foundation excavation and slope cutting. Therefore, these activities are not likely to consume a large quantity of soil and contribute to a soil shortage.	There would be 1813 to 363 acres of soil disturbance and loss of soil with mineralogical and biological composition capable of supporting unique vegetation at SSFL. 249,500 to 969,300 cubic yards of backfill would be needed. It is unlikely that a source of backfill meeting DOE and NASA AOC LUT values would have the same physical and chemical properties as existing SSFL soils.

Resource Area	*DOE Contribution to Cumulative Impacts*	*NASA and Boeing Contribution to Cumulative Impacts*	*Other Contributions to Cumulative Impacts*	*Cumulative Impacts*
Surface water resources	With implementation of control and mitigation measures, DOE's actions would generate no impacts on surface water quality or on local and regional stormwater control capacity, and would not contribute to cumulative impacts. Cleanup would result in a long-term reduction of potential sources of surface water contamination.	With implementation of control and mitigation measures, NASA's and Boeing's actions would generate no impacts on surface water quality or on local and regional stormwater control capacity, and would not contribute to cumulative impacts. Cleanup would result in long-term reduction of potential sources of surface water contamination.	Offsite developments would be subject to compliance with stormwater pollution prevention plans and BMPs that would limit the potential for increased soil erosion and sediment loading in runoff during construction and operation.	With implementation of control and mitigation measures, DOE, NASA, and Boeing actions at SSFL would generate no impacts on surface water quality or local and regional stormwater control capacity and would not be expected to contribute to cumulative impacts. Cleanup would result in long-term reduction of potential sources of surface water contamination.
Groundwater resources	Impacts on the quantity of site groundwater are expected to be minimal because groundwater would not be withdrawn during soil excavation. If required, removal of 200,000 gallons of groundwater during demolition of one of the DOE buildings would have a short-term, localized impact on water levels. Because of the relatively small size of SSFL compared to the adjacent groundwater basins and the relatively small quantity of groundwater that would be withdrawn, none of the proposed groundwater remediation technologies are expected to have an appreciable impact on the quantity of groundwater available for use by populations in adjacent groundwater basins. DOE groundwater cleanup activities at SSFL would have a long-term beneficial impact on groundwater quality.	Impacts on the quantity of site groundwater are expected to be minimal because groundwater is deeper beneath the NASA- and Boeing-administered areas and is expected to be withdrawn during soil excavation. Because of the relatively deep groundwater and because the buildings and other structures have shallow foundations, demolition of buildings is not expected to require dewatering. Because of the relative size of SSFL compared to the adjacent groundwater basins and the relatively small quantities of groundwater that are expected to be withdrawn, none of the proposed groundwater remediation technologies is expected to have an appreciable impact on the quantity of groundwater available for use by populations in adjacent groundwater basins. NASA and Boeing groundwater cleanup activities at SSFL would have a long-term beneficial impact on groundwater quality.	No other contributions to cumulative impacts in the ROI were identified.	Because of the relatively small size of SSFL compared to the adjacent groundwater basins, the depth to the aquifer, and the relatively small quantities of groundwater that would be withdrawn, none of the proposed remediation technologies are expected to have an appreciable impact on the quantity of groundwater available for use by populations in adjacent groundwater basins. Groundwater cleanup activities at SSFL would have a long-term beneficial impact on groundwater quality.

Resource Area	*DOE Contribution to Cumulative Impacts*	*NASA and Boeing Contribution to Cumulative Impacts*	*Other Contributions to Cumulative Impacts*	*Cumulative Impacts*
Biological resources	Approximately 9 to 99 acres of habitat would be disturbed by removal of vegetation and soils, including about 5 to 33 acres of relatively undisturbed native habitat. Removal of existing vegetation and topsoil would increase the difficulty of re-establishing native plant species and would reduce or eliminate the value of habitat for most wildlife species until the vegetation has re-established. Remediation would require prolonged efforts to restore native vegetation and wildlife habitat. If backfill is substantially different than that originally present, it may not support native vegetation.	Approximately 194 to 275 acres of habitat would be disturbed. Similar impacts as described for DOE. Approximately 11 acres of additional undeveloped land in the Southern Buffer Zone could be disturbed if Boeing uses these areas as sources of clean backfill.	Projects outside SSFL are generally sufficiently distant to minimize the potential for cumulative effects with the remediation projects on SSFL. However, certain proposed projects (such as Sterling Properties in Dayton Canyon) developed on land that supports threatened, endangered, or rare species or relatively undisturbed native habitat, and of the same type that would be affected by SSFL remediation activities (e.g., oak woodlands and habitat for Braunton's milk-vetch and Santa Susana tarplant), could have cumulative adverse impacts.	Approximately 235 to 414 acres of habitat would be disturbed at SSFL. The combined soil excavation and building removal activities of DOE, NASA, and Boeing would cause profound disturbance (removal of vegetation and soils). The effects of vegetation and soil removal could result in long-term impacts due to the intense effort needed to restore the habitat. Simultaneous implementation of remediation activities by DOE, NASA, and Boeing would create cumulative disturbance of habitat and could interfere with regional movement of wildlife species such as mountain lion, bobcat, and ringtail.

Resource Area	*DOE Contribution to Cumulative Impacts*	*NASA and Boeing Contribution to Cumulative Impacts*	*Other Contributions to Cumulative Impacts*	*Cumulative Impacts*
Air quality and climate	Onsite activities would not contribute to exceedance of an ambient air quality standard at an offsite location. There would be up to 32 peak day heavy-duty truck round trips (the maximum from SSFL between DOE, NASA, and Boeing would be 96, per the Transportation Agreement [Boeing 2015a]). These trips would extend across hundreds of miles of roadways, depending on the route taken to a disposal facility. As a result, emissions would be dispersed in the atmosphere to the point that they would produce minimal impacts in a localized area. Implementation of a green cleanup truck fleet proposed by DOE would minimize project air quality impacts. The total carbon dioxide emissions generated by the high DOE combination of alternatives would be 88,000 metric tons.	Onsite activities would not contribute to exceedance of an ambient air quality standard at an offsite location. There would be 48 to 64 daily heavy-duty truck round trips. As a result, emissions would be dispersed in the atmosphere to the point that they would produce minimal impacts in a localized area. NASA and Boeing cleanup actions would emit about 139,000 and 14,000 metric tons of carbon dioxide, respectively.	Numerous cumulative projects, such as those listed in Appendix D, Table D-7, would cause additional emissions impacts within Ventura County and the South Coast Air Basin.	Onsite activities would not contribute to exceedance of an ambient air quality standard at an offsite location, except possibly for occasional exceedances of particulate matter standards. For the South Coast Air Basin region, an area already in extreme nonattainment for the ambient ozone standards, emissions of ozone precursors from DOE activities, in combination with ozone precursor emissions from cumulative projects, would have the potential to contribute to exceedance of an ozone standard. Emissions generated from proposed DOE activities outside of Ventura County and the South Coast Air Basin would be diluted in the atmosphere and would produce minimal impacts in a localized area. Emissions from DOE trucks traveling within the San Joaquin Valley Air Basin (which has extreme nonattainment for ambient ozone standards), combined with cumulative emissions from other traffic has the potential to contribute to an exceedance of an ambient ozone standard within this region. Implementation of a green cleanup truck fleet proposed by DOE would minimize project air quality impacts. The total cumulative carbon dioxide emissions generated by SSFL cleanup activities would be 232,000 metric tons, a negligible contribution to future climate change.

Resource Area	*DOE Contribution to Cumulative Impacts*	*NASA and Boeing Contribution to Cumulative Impacts*	*Other Contributions to Cumulative Impacts*	*Cumulative Impacts*
Noise	The nearest residence is approximately 5,000 feet from the Area IV boundary and would experience an approximate 50 dBA equivalent sound level during workday hours. DOE shipments would average about 16 per day but in any case would remain at or below 32 per day throughout all stages of the project. On a day with 32 heavy-duty truck round trips, time-averaged noise levels in residential and recreation areas along potential haul routes are expected to increase by up to 1.4 dBA CNEL, where the final noise level would be below 65 dBA CNEL (the threshold for an adverse impact is an increase of 5 dBA CNEL) or, where the final noise level would exceed 65 dBA CNEL, the noise level would increase by no more than 1.2 dBA CNEL (the threshold for an adverse impact when the final noise level exceeds 65 dBA CNEL is an increase of 3 dBA CNEL).	Remediation activities conducted by NASA and Boeing are expected to generate noise levels similar to those generated by DOE remediation activities.	Offsite residential, commercial, and industrial development projects typically generate temporary localized elevated noise levels at the construction site, temporary increases in construction truck traffic noise along nearby roads, and localized increases in noise levels during project operation. Construction and operations noise would be localized near the individual project sites following a similar pattern to noise levels described for construction activities on SSFL. Therefore, noise from offsite development projects would generally not be cumulative with activities on SSFL.	Projected noise levels at the closest residence to onsite remediation activities would be well below 65 dBA community noise equivalent level. Assuming the maximum authorized number of daily round trips from Area IV (96 total round trips by DOE, NASA, and Boeing), time-averaged noise levels in residential and recreation areas along potential haul routes are expected to increase by up to 4.7 dBA CNEL, where the final noise level would be below 65 dBA CNEL (the threshold for an adverse impact is an increase of 5 dBA CNEL) or, where the final noise level would exceed 65 dBA CNEL, the noise level would increase by no more than 1.3 dBA CNEL (the threshold for an adverse impact when the final noise level exceeds 65 dBA CNEL is an increase of 3 dBA CNEL). Although cumulative noise levels would not be greater than the levels for DOE activities alone, these higher levels would occur for a longer period of time. In a hypothetical scenario where a development project was undertaken adjacent to existing residences, the noise of the development project would be dominant, and distant noise generated at SSFL, which is more than 5,000 feet from the closest residence, would not contribute appreciably to overall noise levels. Truck trips conducted in support of other projects in the ROI could potentially follow portions of the same routes used by SSFL trucks. Any cumulative increase in truck traffic noise would be temporary. Therefore, only minor cumulative noise impacts are expected.

Resource Area	*DOE Contribution to Cumulative Impacts*	*NASA and Boeing Contribution to Cumulative Impacts*	*Other Contributions to Cumulative Impacts*	*Cumulative Impacts*
Transportation	**Radiological impacts:** No potential LCFs are estimated to occur. **Nonradiological impacts:** Approximately 0 to 2 potential accident fatalities are estimated depending on the Alternative from DOE transportation activities.	**Radiological impacts:** No LCFs would be anticipated.[a] Boeing remediation activities are not expected to generate any radioactive waste. **Nonradiological impacts:** Up to 1 potential accident fatality is estimated from NASA and Boeing transportation activities.	**Radiological impacts:** The total number of potential LCFs (among the workers and general population) estimated to result from nationwide radioactive material transportation over the period between 1943 and 2073 is 514, or an average of 4 LCFs per year. The transportation-related LCFs represent about 0.0007 percent of the total number of cancer deaths expected over the same time period; therefore, this rate is indistinguishable from the natural fluctuation in the annual death rate from cancer. **Nonradiological impacts:** 100,320 estimated traffic fatalities occurring in California from 2019-2046. 26,530 estimated traffic fatalities in the four neighboring counties (2019-2046).	**Radiological impacts:** No LCFs would be anticipated. The potential doses from transport of radioactive materials associated with remediation activities at SSFL are insignificant compared to the doses from other nuclear material shipments. The majority of the cumulative risk to workers and the general population would be due to general transportation of radioactive material unrelated to remediation activities at SSFL. **Nonradiological impacts**: 0 to 3 potential accident fatalities are estimated to result from SSFL (DOE, NASA, and Boeing) transportation activities; representing about up to 0.004 percent of the total number of traffic fatalities expected in California and up to about 0.014 percent of the total number of traffic fatalities expected in the four surrounding counties. The potential traffic fatalities from operations at SSFL are indistinguishable from the natural fluctuation in the total annual death rate from traffic fatalities.
Traffic	**Level of service:** Largest weekday, average daily traffic increase would be on Woolsey Canyon Road (about 3.3 to 8.6 percent). The LOS on Woolsey Canyon Road could degrade from LOS B to C for approximately 4 to 12 years. **Pavement deterioration:** 6,900 to 104,000 heavy-duty truck trips depending on the action alternative combination; from 15,000 (Low Impact Combination) to 226,000 (High Impact Combination) equivalent single axle loads would be imposed on SSFL-area road pavement by vehicles associated with DOE remediation activities.	**Level of service:** Largest weekday, average daily traffic increase would be on Woolsey Canyon Road (about 20 percent). The LOS on Woolsey Canyon Road could degrade from LOS B to C. **Pavement deterioration:** 72,000 to 96,000 heavy-duty truck trips depending on the remediation option; from 147,000 to 196,000 equivalent single axle loads would be imposed on SSFL-area road pavement by vehicles associated with DOE remediation activities.	**Level of service:** Current level of service on routes from SSFL ranges from B (stable traffic flow with no delay) to F (forced traffic flow with considerable delay). **Pavement deterioration:** SSFL-area road pavement would deteriorate over time due to the passage of vehicles including heavy-duty trucks not associated with SSFL remediation. Pavements are designed to accommodate a design number of ESALs over a projected service length, and when design ESALs are exceeded, the result is a decrease in pavement service life.	**Level of service:** Largest percentage traffic increase would be on Woolsey Canyon Road (about 29 percent). The LOS on Woolsey Canyon Road could degrade from LOS B to C. **Pavement deterioration:** 80,000 to 199,000 heavy- and medium-duty truck trips associated with DOE. NASA, and Boeing remediation activities, depending on the DOE action alternative combination and the range in shipments by NASA; from 162,000 to 422,000 equivalent single axle loads would be imposed on SSFL-area road pavement by vehicles associated with DOE, NASA, and Boeing remediation activities. Between 7 and 61 percent of the equivalent single axle loads would be attributable to DOE activities. Increased truck traffic could damage the roads, causing them to need repair sooner than currently anticipated.

Resource Area	*DOE Contribution to Cumulative Impacts*	*NASA and Boeing Contribution to Cumulative Impacts*	*Other Contributions to Cumulative Impacts*	*Cumulative Impacts*
Human health	A hypothetical onsite suburban resident or recreational user is assumed to be exposed to contaminated soil in Area IV for 24 hours a day, 350 days per year for 26 years, consistent with the current EPA default recommendations. A hypothetical recreational user is assumed to be exposed 8 hours per day for 75 days per year for 30 years. Worker exposure to chemical and radioactive constituents could occur during soil remediation, building demolition, and groundwater remediation. Physical and administrative controls would be employed to ensure that workers would be protected in compliance with DOE requirements for worker safety and radiation protection. Radiation protection practices would be employed so that radiation doses are ALARA.	Because the DOE onsite suburban resident scenario already includes exposure for 24 hours a day, 350 days per year for 26 years, no additional time could be spent on NASA or Boeing areas of SSFL. The total exposure time for a hypothetical recreational user would not increase, regardless of which area of SSFL is being traversed. Worker exposure to chemical and radioactive constituents could occur during soil remediation, building demolition, and groundwater remediation. Physical and administrative controls would be employed to ensure that workers would be protected in compliance with regulatory requirements for worker safety and radiation protection	None identified.	Because the onsite suburban resident scenario conservatively includes exposure for 24 hours a day, 350 days per year for 30 years, no additional time could be spent on NASA or Boeing areas of SSFL. A resident can only be in one area at a time and cannot be in both areas simultaneously. Therefore, the effects are not additive, and the cumulative effect cannot be greater than the greater of the individual area efforts. The offsite impacts have been shown to be several orders of magnitude less the threshold for alternative comparison. Therefore, the impacts from adjacent areas under control of NASA or Boeing to a resident in Area IV are also expected to be insignificant and would result in a minimal addition to cumulative impacts because these areas are separated by significant distances relative to a residential exposure scenario. Likewise, the contributions from Area IV to hypothetical onsite suburban residents in NASA or Boeing remediation areas also would be small and would make a minimal addition to cumulative impacts. It is unlikely that the same workers would perform remediation work for DOE, NASA, and/or Boeing because remediation activities are planned to occur in overlapping years. If workers do perform remediation work in more than one area, they can only be in one area at a time and would not be exposed to both simultaneously. Whatever time they spend in one area would take away from the time they could spend in another area and would be limited to applicable regulatory standards and guidelines. Because work practices during excavation or demolition would control dust, impacts would be localized to the work area. Therefore, contributions from remediation activities in one area of SSFL on remediation workers in an adjacent area would only minimally add to cumulative impacts on worker health.

Resource Area	*DOE Contribution to Cumulative Impacts*	*NASA and Boeing Contribution to Cumulative Impacts*	*Other Contributions to Cumulative Impacts*	*Cumulative Impacts*
Waste management	Considering all DOE soil remediation, building demolition, and groundwater remediation activities, DOE would generate 200 to 110,000 cubic yards of LLW/MLLW, about 2,0000 cubic yards of hazardous waste, 36,000 to 769,000 cubic yards of nonhazardous waste, and 3,540 cubic yards of recyclable material.	Considering all soil remediation and building removal activities, NASA could generate 87,000 cubic yards of LLW/MLLW [a] (no LLW/MLLW would be generated by Boeing). NASA and Boeing combined would generate 489,700 to 752,700 cubic yards of hazardous waste, 398,000 cubic yards of nonhazardous waste, and 37,700 cubic yards of recyclable material.	None identified.	DOE is estimated to generate and ship off site about from less than 1 to 56 percent of the SSFL cumulative volume of LLW and MLLW, less than 1 percent of the cumulative volume of hazardous waste, 3 to 66 percent of the cumulative volume of nonhazardous waste (primarily soil), and about 9 percent of the cumulative volume of recyclable material. Sufficient capacity exists for all types of waste generated by DOE, NASA, and Boeing, and the impact on any single facility's capacity can be reduced by sending waste to multiple disposal facilities.
Cultural resources	**Archaeological resources:** Some archaeological sites may be impacted by cleanup activities. In accordance with the Section 106 Programmatic Agreement currently under development, DOE will prepare one or more HPTP(s). The HPTP(s) will document which historic properties will be avoided, if any; describe the scope of the adverse effects on historic properties that cannot be avoided; and, as appropriate, include measures to minimize and mitigate such adverse effects, the manner in which these measures will be carried out, and a schedule for their implementation. **Architectural resources:** No structures located in DOE-administered areas are NRHP-eligible. **Traditional cultural resources:** The character-defining traits of the traditional cultural resources at Area IV and the NBZ include all archaeological and natural resources, settings, and viewsheds. Cleanup activities would affect some archaeological resources. Plants and animals may be disturbed, dislocated, or destroyed. Beneficial impacts would be achieved through	**Archaeological resources:** NRHP–eligible areas on NASA-administrated lands would be addressed through implementation of its Programmatic Agreement under Section 106 of the NHPA. **Architectural resources:** NASA proposes to preserve one or more NRHP-eligible structures, but demolition of other structures would contribute to cumulative effects. **Traditional cultural resources:** Impacts from NASA and Boeing activities on traditional cultural resources would have similar impacts as those described for DOE.	Of the 126 actions identified within 10 miles of SSFL, as many as 21 have the potential to contribute to cumulative impacts. **Archaeological resources:** Large-scale developments outside SSFL would contribute to cumulative adverse impacts if archaeological sites are encountered during project construction, paved over, or disturbed at a later date due to human activity. **Architectural resources:** None specifically identified. **Traditional cultural resources:** Loss of defining characteristics of traditional cultural values at other locations within the ROI could add to cumulative impact on the viewsheds.	**Archaeological resources:** The overall trend in the region is toward a reduction in archaeological sites, as these impacts accumulate. Where NHPA is applicable, adverse effects to NRHP-eligible sites would be mitigated, but mitigation could include removal of the site. Where NHPA is not applicable, or where sites are not eligible, sites may be removed from the overall inventory of archaeological resources without mitigation. Potential destruction of NRHP-eligible sites in Area IV and the NBZ would add to cumulative, regional impacts. However, this would be a small contribution to cumulative, regional impacts due to the small number of sites impacted and the implementation of mitigation measures through the Section 106 Programmatic Agreement. The overall number of archaeological sites in the region, particularly those that are not eligible for the NRHP, could continue to be reduced as a result of past, present, and reasonably foreseeable future actions. **Architectural resources:** Because there are no NRHP-eligible structures within the DOE area of potential effects, DOE cleanup activities would have no cumulative effect on architectural resources. **Traditional cultural resources:** Cumulative adverse effects on traditional cultural resources are likely as cleanup occurs on the entire SSFL and as development occurs in previously undeveloped land in the ROI, including in areas with intact landscapes or remote locations where traditional resources may still retain integrity. Beneficial impacts would be achieved through restoration of viewsheds by removal

Resource Area	DOE Contribution to Cumulative Impacts	NASA and Boeing Contribution to Cumulative Impacts	Other Contributions to Cumulative Impacts	Cumulative Impacts
	restoration of viewsheds by removal of structures. Removal of contamination could also be beneficial.			of structures at SSFL. Removal of contamination at SSFL could also be beneficial.
Socio-economics	**Employment:** DOE onsite activities would require 85 workers. Workers would likely originate primarily from Ventura and Los Angeles Counties. **Truck Drivers and Traffic:** DOE would require from 7 to 41 truck drivers. A maximum of 41 truck drivers could be required for 2-day one-way truck trips to distant facilities. Traffic conditions near businesses would not change substantially. **Infrastructure and Municipal Services:** Impacts on roads would result in impacts on local government funding and expenses. DOE may need to negotiate with local governments to contribute its portion of the cost for maintenance and repair of affected roads. **Housing Availability:** Because workers would likely originate from the region, changes to housing availability are not expected. **Disposal facility impacts:** Increases in truck traffic are not expected to have a cumulative adverse economic impact on local businesses near disposal facilities because the maximum number of daily truck trips would be relatively small. The largest number of daily shipments would be to a nonhazardous waste facility (25 shipments).[b]	**Employment:** NASA and Boeing onsite activities would require 150 to 175 workers. Workers would likely originate primarily from Ventura and Los Angeles Counties. **Truck Drivers and Traffic:** NASA and Boeing would require an estimated 30 to 132 truck drivers. A maximum of 202 truck drivers could be required for 2-day truck trips to distant facilities. Traffic conditions near businesses would not change substantially. **Infrastructure and Municipal Services:** Impacts on roads would result in impacts on local government funding and expenses. **Housing Availability:** Because NASA and Boeing workers would likely originate from the region, changes to housing availability are not expected. **Disposal facility impacts:** Increases in truck traffic are not expected to have a cumulative adverse economic impact on local businesses near disposal facilities because the maximum number of daily truck trips would be relatively small. The largest number of daily shipments would be to a nonhazardous waste facility (42 shipments).[b]	The populations in Los Angeles and Ventura Counties are projected to increase by 9 percent from 2013 through 2030. **Employment:** More than 117,000 construction workers are in the region. **Truck Drivers and Traffic:** Approximately 7,200 workers are employed in specialized freight trucking in the region, plus approximately 26,600 employees in general truck transportation. **Infrastructure and Municipal Services:** Population growth could increase traffic levels, but also could increase spending by local and State government agencies on roadways and mass transit projects. **Housing Availability:** Projected population growth in the ROI would increase the demand for housing. Future housing development is expected to meet the demands of population growth. **Disposal facility impacts:** None identified.	**Employment:** SSFL remediation activities would require 235 to 260 workers. SSFL site activities would have a minor beneficial impact on the economy in Los Angeles and Ventura Counties by providing employment and increasing sales for industries that provide equipment, supplies, and rentals. Because workers would likely originate from the region, new spending in the region would be minimal. **Truck Drivers and Traffic:** Employment of 37 to 173 SSFL truck drivers would represent 1 to 4 percent of the available truck drivers in Los Angeles and Ventura Counties, and would not adversely affect the truck transportation industry. Traffic conditions near businesses would not change substantially. Business sales and revenues would not change substantially. **Infrastructure and Municipal Services**: DOE truck trips would represent 10 to 52 percent of the total shipments from SSFL. Impacts on roads would result in impacts on local government funding and expenses. DOE activities would not require additional services, so there would be no cumulative impacts on other municipal services. **Housing Availability:** Because SSFL workers would likely originate from the region, changes to housing availability are not expected. **Disposal facility impacts:** Increases in truck traffic from SSFL waste disposal activities are not expected to have a cumulative adverse economic impact on businesses near waste disposal facilities because the maximum number of daily truck trips would be relatively small. DOE estimates that the combined maximum daily truck shipments arriving at a nonhazardous waste facility would be 43.[b] DOE estimates the maximum daily truck shipments to facilities for other types of waste would be less – 17 at LLW or MLLW facilities, 39 at hazardous waste facilities, and 4 at recycle facilities (see Appendix D).[c]

Resource Area	DOE Contribution to Cumulative Impacts	NASA and Boeing Contribution to Cumulative Impacts	Other Contributions to Cumulative Impacts	Cumulative Impacts
Environmental justice	Impacts on minority and low-income populations would be the same as those experienced by the general population. Therefore, no disproportionately high and adverse effects on minority and low-income populations are expected.	Impacts on minority and low-income populations would be the same as those experienced by the general population. Therefore, no disproportionately high and adverse effects on minority and low-income populations are expected.	None identified.	Cumulative impacts on minority and low-income populations would be the same as those experienced by the general population. Therefore, no disproportionately high and adverse cumulative effects on minority and low-income populations are expected.
Sensitive-aged populations	Impacts on sensitive-aged populations would be the same as those experienced by the general population. No disparate impacts (markedly distinct impacts relative to those on the general population) on sensitive-aged populations are expected.	Impacts on sensitive-aged populations would be the same as those experienced by the general population. No disparate impacts on sensitive-aged populations are expected.	None identified.	Cumulative impacts on sensitive-aged populations would be the same as those experienced by the general population. Because there would be adverse cumulative impacts on members of the public, there would be no disparate cumulative impacts on sensitive-aged populations.

ALARA = as low as reasonably achievable; AOC = *Administrative Order on Consent for Remediation*; BMP = best management practices; Boeing = The Boeing Company; CMWD = Calleguas Municipal Water District; CNEL = community noise equivalent level; dBA = decibels A-weighted; HPTP = Historic Properties Treatment Plan; LCF = latent cancer fatality; LLW = low-level radioactive waste; LOS = level of service; LUT = Look-Up Table; MLLW = mixed low-level radioactive waste; NASA = National Aeronautics and Space Administration; NBZ = Northern Buffer Zone; NHPA = National Historic Preservation Act; NRHP = *National Register of Historic Places*; ROI = region of influence; SRAM = *Final Standardized Risk Assessment Methodology Revision 2 Addendum, Santa Susana Field Laboratory, Ventura County, California* (MWH 2014).

[a] NASA did not conduct radiological operations in its areas of SSFL; estimated quantities of radioactive waste from NASA remediation are due to naturally occurring isotopes and the LUT values established in accordance with the 2010 NASA *Administrative Order on Consent for Remedial Action* (DTSC 2010b).

[b] The years in which the maximum number of daily waste deliveries may occur for different waste types would be different for DOE, NASA, and Boeing. For example, the maximum daily deliveries of nonhazardous waste from NASA and Boeing combined would likely occur when the number of DOE is shipments small (due to DOE's planned sequence of activities). Therefore, the combined maximum daily delivery is not the sum of the individual organizations' maximum daily deliveries.

[c] In accordance with a Transportation Agreement between DOE, NASA, and Boeing (Boeing 2015a), the maximum total number of daily heavy-duty truck round trips from SSFL would be limited to 96. The 96 heavy-duty truck round trips would be split between activities such as trips to disposal facilities or recycle facilities and shipment of backfill to SSFL. Therefore, it is highly unlikely that 96 shipments per day to any single disposal facility would occur.

S.12 Conclusions

S.12.1 Areas of Potential Controversy

As a result of preparing this EIS and based on public comments received during the EIS scoping periods and Draft EIS comment period, as well as ongoing community interactions at the site (for example, town hall meetings and DTSC update meetings), the following are areas of controversy that DOE expects will be raised by stakeholders:

- **Appropriate Cleanup Level** – DTSC established AOC LUT values consistent with the 2010 AOC, which requires cleanup to background levels or to levels based on laboratory capabilities (i.e., minimum detection limits). The Cleanup to AOC LUT Values Alternative evaluated in this EIS analyzes the potential impacts that would result from implementation of cleanup to the AOC LUT values.

  Considering that implementation of the Cleanup to AOC LUT Values Alternative poses technical challenges (for example, requiring 132 individual chemical and radioactive constituents to meet their respective LUT values and clearly distinguishing between contamination and background concentrations); would have significant environmental impacts and higher costs than other soil remediation alternatives (see Appendix K); and would result in minimal reduction in human health risk (see Appendix K and text box in Section S.2.10.5); DOE evaluated two alternatives (one with two scenarios) in this EIS that are based on risk. The Cleanup to Revised LUT Values Alternative uses the same LUT values for radioactive constituents as the Cleanup to AOC LUT Values Alternative, but proposes RBSLs as the revised LUT values for chemicals. These revised LUT values for chemicals were derived from the suburban resident scenario[43] evaluated in the SRAM (MWH 2014) and are based on a risk of 1 chance in 1 million of developing cancer for carcinogenic chemicals and a hazard index of 1 for noncarcinogenic chemicals (or on an ecological RBSL if that value is lower). Under the Cleanup to Revised LUT Values Alternative, the LUT values apply individually to each chemical or radionuclide. The Conservation of Natural Resources Alternative, Residential Scenario also evaluates an onsite suburban residential scenario, but applies a CERCLA risk-assessment approach consistent with EPA guidance that evaluates the collective impact of an area (that is, it uses the average concentration of constituents across a defined exposure unit and evaluates the total chemical risk). In addition, in this Final EIS, DOE included a Conservation of Natural Resources Alternative, Open Space Scenario that evaluates the potential impacts on a recreational user of Area IV and the NBZ; this scenario is consistent with Boeing's conservation easements. Under the Conservation of Natural Resources Alternative, DOE would remediate soil to reduce the concentrations of chemical and radioactive constituents to levels protective of human health and ecological resources.

  Inclusion of these latter alternatives in the analysis allows decision-makers to consider the potential impacts associated with cleanup to the AOC LUT values against risk-based approaches.

[43] Multiple exposure scenarios were evaluated in the SRAM (MWH 2014). Boeing and North American Land Trust recorded two Grant Deeds of Conservation Easement and Agreements (conservation easements) with Ventura County (Ventura County 2017a, 2017b) that permanently preserve as open space the land that Boeing owns at SSFL, including Area IV and the NBZ. The conservation easements are legally enforceable documents that forever prohibit residential, agricultural, or commercial development or uses of the site. Regardless, the revised LUT values for chemicals are conservatively based on the suburban resident scenario direct pathways of inhalation, incidental ingestion, and dermal contact.

- **Cleanup Consistent with the 2010 AOC** – DOE received comments implying that DOE was not complying with the 2010 AOC, that the EIS violated the AOC, and that DOE was trying to get out of the AOC. Since signing the AOC in December 2010, DOE has and will continue to comply with the AOC.

  In accordance with Section 2.4 of the 2010 AOC, DOE established an agreement with EPA under which EPA conducted a radiological soil background study and a radiological investigation of Area IV. In accordance with Section 2.5, DOE conducted the required soil chemical investigation activities, including co-located sampling (chemical and radionuclide) with EPA; random soil sampling with EPA in the NBZ; and performing a data gap analysis, developing a sampling plan, and completing additional soil sampling. As required by Section 2.7, DOE reported the results of its soil characterization efforts to DTSC in a *Draft Chemical Data Summary Report* (CDM Smith 2017).

  Section 2.6 of the 2010 AOC provides the basis for soil treatability studies. DOE contracted with California Polytechnic State University, San Luis Obispo and University of California, Riverside to perform the studies. The studies were scoped through a series of community meetings led by Sandia National Laboratory starting in 2011. Studies were started in 2012 and continued into 2014. Reports for the studies were issued in 2015. Consistent with Section 3.0 DOE has provided opportunities for public participation. Throughout the scoping of the chemical soil investigations, DOE hosted a series of meetings; the same was done for the soil treatability studies. Sampling documents and study plans were posted on the DOE web site for review.

  Section 6.1 of the 2010 AOC recognizes that DOE is required to prepare this EIS under a court order. Section 6.2 acknowledges that once completed, DOE and DTSC may need "to make any necessary modifications" to the AOC. In compliance with NEPA, DOE was required to evaluate a range of reasonable alternatives as analyzed in this EIS.

  Section 7.11 of the 2010 AOC states that, "All actions taken pursuant to this Order [the AOC] by DOE shall be undertaken in accordance with applicable local, State, and federal laws and regulations." Accordingly, DOE has consulted with the USFWS under the ESA as specifically called for in the Agreement in Principal (Attachment B of the AOC), with a resulting Biological Opinion (see Appendix J) under which an exemption process will be applied for protection of federally protected biological resources. Meetings with USFWS were also attended by CDFW and DTSC. Complying with other applicable laws and regulations, DOE expanded the exemption process to protect State-listed endangered species, and species of State and local importance.

  The Agreement in Principle also provides for protection of "Native American artifacts that are formally recognized as Cultural Resources." In compliance with Federal law, DOE is consulting with the California SHPO regarding resources subject to the NHPA. The application and scope of the phrase "Native American artifacts that are formally recognized as Cultural Resources" will be determined in cooperation with DTSC and in consultation with the California SHPO, Santa Ynez Band of Chumash Indians, other tribes, and other consulting parties involved in the NHPA, Section 106 process.

  Section 8.0 of the 2010 AOC recognizes the potential need for modification of the AOC. DOE's evaluation of the implementability of the AOC has identified concerns that need to be addressed with DTSC. Throughout the process of implementing the 2010 AOC, DOE has worked closely with DTSC staff on technical issues. This includes the backfill issue, the need to incorporate natural occurring TPH chemicals in soil cleanup considerations, and the

development of the exemption process to protect sensitive biological and cultural resources. DOE continues a dialog with DTSC to address identified issues.

The Cleanup to AOC LUT Values Alternative evaluated in this EIS was developed as the alternative that complies with the technical elements of the 2010 AOC (e.g., point-by-point cleanup to the LUT values). In comments on the Draft EIS, commenters stated that none of the alternatives, including the Cleanup to AOC LUT Values Alternative, implemented the 2010 AOC. DOE applied provisions of the 2010 AOC and made adjustments to the areas and volumes of soil that would be removed. DOE proposed allowing soils exceeding the TPH value to remain on site, consistent with the provision for onsite treatment and the chemical AOC LUT footnote stating that, "For locations where TPH is the sole contaminant, a cleanup strategy will be considered based on the findings of soil treatability study." DOE also identified areas in which the exemption process would be applied for protection of biological and cultural resources. The 2010 AOC specifically acknowledges use of the process for species or habitat protected under the Federal ESA. The 2010 AOC also acknowledges that actions by "DOE shall be undertaken in accordance with applicable local, State, and federal laws and regulations." Accordingly, DOE also proposed areas in which the exemption process would be applied to comply with State and local requirements for protection of other species and habitats. Known locations of Native American artifacts were also included in area in which the exemption process would be applied and will be addressed as noted above.

- **Cleanup Completed by 2017** – The 2010 AOC called for remediation of Area IV and the NBZ to be completed by 2017. Since the 2010 AOC was signed, significant efforts to characterize Area IV, the NBZ, and background soils were undertaken by DOE, EPA, and DTSC. Soil characterization and background studies were necessary preliminary actions to developing the AOC LUT values, developing preliminary remediation designs, and preparing required environmental documents. In June 2017, DOE submitted a letter to DTSC documenting the mutually acknowledged situation that cleanup cannot proceed until required environmental documents (e.g., this EIS, the DTSC program environmental impact report) are completed and that DOE was therefore unable to meet the 2017 cleanup expectations as described in the 2010 AOC (DOE 2017).
- **Soil Volume Requiring Remediation** –To enable DOE to provide a basis for the analysis in this EIS and eventually plan the cleanup activities, an estimate of the volume of soil exceeding the chemical and provisional radiological AOC LUT values was needed. DOE used the analytical results from over 11,000 soil samples (3,542 soil samples taken by EPA for radiological sampling, 5,854 samples taken by DOE for chemical characterization, and 2,259 RFI samples) to develop an estimate. Based on a comparison of the results for each sample with AOC LUT values, in the Draft EIS, DOE estimated that the volume of soil in which one or more chemical or radioactive constituents does not meet the AOC LUT values was about 1,413,000 cubic yards, but acknowledged that due to uncertainties, the volume could range from approximately 1,000,000 to 2,500,000 cubic yards. In comments on the Draft EIS, there were those who felt that the soil volume estimate was inflated and there were others who thought that DOE may have underestimated the volume of soil that exceeded the AOC LUT values. For this Final EIS, DOE again used geographic information system analysis of the results of the sampling data to estimate a volume of soil exceeding the AOC LUT values. DOE added a 20 percent uncertainty factor to the soil volume and estimated the volume of soil exceeding one or more AOC LUT values to be 1,616,000 cubic yards. The method of estimating the soil volume and inclusion of a factor to account for uncertainty is appropriate for this NEPA analysis. DOE included a sensitivity evaluation in this Final EIS (see Appendix L) that compares the impacts of the Cleanup to AOC LUT Values Alternative to those that

would occur if natural attenuation of TPH soil and application of the exemption process were not included (i.e., excavating the entire 1,616,000 cubic yards).

- **Disposal of Building Debris** – Of DOE's 18 buildings in Area IV, 14 have a history involving use of radioactive materials. The other four buildings were used for nonradiological research, storage, or offices and do not have a history of handling radioactive materials. Some members of the public have questioned whether the buildings that do not have a radiological history could be radioactively contaminated because of past releases of radioactive materials in Area IV. Some people are also concerned about where DOE will dispose of material resulting from building demolition.

  If the Building Removal Alternative is selected in a ROD, DOE would completely remove all 18 of its buildings in Area IV, including foundations and basements. For the nonradiological facilities, DOE would apply DOE Orders (e.g., DOE Order 458.1) and industry-accepted guidance and practices to characterize the facilities to determine the appropriate disposition of demolition debris. Any parts of buildings determined to have radioactive contamination would be disposed of as radioactive waste.

- **Water Use During Drought Conditions** – Cleanup of SSFL Area IV and the NBZ will require a large volume of water. Based on the estimates of soil volumes to be removed, an estimated 1.75 million gallons of water would be needed annually, representing about 0.004 percent of CMWD's current imported and local water supply, principally to suppress dust generated during remediation actions in accordance with Federal, State, and local regulatory requirements. The Cleanup to AOC LUT Values Alternative would require this water use over a much longer time compared to the other soil remediation action alternatives (26 years compared to a little more than 6 years under the Cleanup to Revised LUT Values Alternative and 2 years or less under the Conservation of Natural Resources Alternative [both scenarios]).

  Water use is an important consideration in the comparison of soil remediation alternatives. Any new demand for water is likely to be controversial because of the long-term California drought conditions and the continued emphasis in the State to significantly reduce water consumption.

- **Community Acceptance** – There is a large community interested in the cleanup of SSFL, including those who live in areas near the site and through which trucks travelling to and from the site would pass. Within that community, there are diverse and divergent opinions regarding the approach to SSFL cleanup and what should be accomplished by the cleanup. As shown by the comments received during scoping and on the Draft EIS, there are varying perspectives among community members regarding how "clean" the site must be upon completion of remediation efforts.

  - Some members of the community live along transportation routes and question the necessity for large numbers of trucks transporting waste from SSFL and backfill to SSFL.

  - Some members of the community are concerned about the selection of a remedy consistent with the AOC LUT values and question whether it is necessary. These members support a risk-based cleanup that is protective of human health and environmentally balanced.

  - Other members of the community believe SSFL currently serves as a healthy ecosystem with vegetation and wildlife similar to adjacent properties. This segment of the

community does not support the Cleanup to AOC LUT Values Alternative, believing the impacts associated with that alternative would inflict unnecessary harm on portions of SSFL that have minimal contamination.

- Some members of the community remain concerned about the risk of cancer and other illnesses from hazardous pollutants at the site and support cleaning all of the contamination because that is the best way to ensure that public health is protected.

DOE believes the decisions to be supported by this EIS are important and that decision-makers will need the full range of reasonable alternatives and careful analysis on which to base decisions.

S.12.2 Issues to Be Resolved

Initiation of Area IV and NBZ remediation is contingent on completing certain regulatory requirements, such as DOE issuing a final EIS and one or more RODs and DTSC issuing a program EIR and finding, negotiating with DTSC any necessary changes to the 2010 AOC, and addressing the Court Order (Case No. 3:04-CV-04448-SC, May 2, 2007). Issuance of those documents and/or implementation of the decisions depend on resolution of several issues. The overarching issue related to soil remediation is the cleanup alternative to be selected by DOE and approved by DTSC. Other issues that affect that decision relate to the concentration of chemical and/or radioactive constituents that would be acceptable to leave on site or to be in backfill soil. Resolution of these issues influences the magnitude and feasibility of the cleanup of Area IV and the NBZ. The following issues require resolution:

- The 2010 AOC (DTSC 2010a) includes exemptions to protect sensitive biological and cultural resources. For several years, DOE informally consulted with the USFWS, CFWS, DTSC, and others regarding species and habitat that should be protected. Subsequently, DOE formally consulted with the USFWS. The USFWS, through its Biological Opinion (see Appendix J), has identified areas for the protection of federally listed species or their habitat in which DOE would only remove soil that exceeds risk-based levels. DOE has identified additional areas for the protection of species and sensitive habitat of State and local concern (e.g., Santa Susana tarplant). DOE has also identified areas in which the exemption process would be applied to address historic properties subject to the NHPA, as well as other cultural resources. For the purposes of the soil remediation alternatives evaluated in this EIS, DOE estimated that 239 acres of the 472 acres in Area IV and the NBZ would be subject to the exemption process for biological or cultural resources – 69 acres of federally listed species or their habitat; 128 acres for State-listed species; 98 acres for sensitive species or habitat (refer to Chapter 3, Section 3.5.5); and 6.2 acres for cultural resources, including historic properties (less than 2 acres of the area identified for protection of cultural resources are outside areas identified for protection biological resources). DOE will propose areas for application of the exemption process in its soil remediation plan(s), as well as identifying the locations within those areas that must be cleaned up to reduce risk. The soil remediation plans are subject to DTSC approval.
- Based on completed soil treatability studies, it appears that natural processes would be appropriate and applicable to the management of soils exhibiting sample results that exceed the TPH AOC LUT value. To support the analysis presented in this EIS, it was assumed that soils with TPH above the AOC LUT value would be allowed to attenuate on site. The estimated volume of soil at locations with only TPH is 620,000 cubic yards. Acceptance of this approach to remediation would have to be negotiated with DTSC; if the existing AOC

LUT values or another cleanup level is applied, all or a portion of 620,000 cubic yards of soil may require removal.

- An estimated 661,000 cubic yards of backfill would be needed to re-contour the site and restore native vegetation under the Cleanup to AOC LUT Values Alternative. Based on DOE's evaluation, as well as evaluations by NASA, no source of backfill has been found that meets the AOC LUT values for concentrations of chemicals. On December 21, 2016, DOE sent a letter to DTSC describing DOE's efforts and difficulty in locating backfill soil that meets the 2010 AOC requirements and requesting initiation of a consultation process addressing backfill (DOE 2016). Even if an adequate source of backfill were found, DOE is uncertain that the soil would have chemical and biological properties sufficiently similar to SSFL soil for successful restoration of Area IV and NBZ native vegetation. Chances of finding acceptable backfill soil are better under the Cleanup to Revised LUT Values Alternative or Conservation of Natural Resources Alternative because the assumed requirements for concentrations of chemicals in the backfill soil would be less stringent.
- The final remedy for groundwater following this EIS also depends on completion of the RCRA Corrective Measures Study being conducted consistent with the 2007 CO (DTSC 2007). DOE submitted its Draft Corrective Measures Study to DTSC in 2018 (CDM Smith 2018b). DOE expects to complete a final Corrective Measures Study prior to issuing a ROD groundwater remediation for this EIS; the final Corrective Measures Study must be approved by DTSC.

S.12.3 Major Conclusions

- The characterization of Area IV and the NBZ has shown that chemical and radioactive constituents are not spread evenly across the site. The risk assessments of potential impacts to a hypothetical onsite suburban resident or an onsite recreational user confirm this conclusion, showing that chemicals and radionuclides that pose a risk or hazard to a future site user are located in comparatively small, discrete locations (see Figures S–8 and S–9). This implies that the greatest effect on reducing risk to human health would be from focusing on the removal of soil from those locations in Area IV and the NBZ with the highest concentrations of chemical and/or radioactive constituents. The largest reduction in risk would occur between the No Action Alternative and the Conservation of Natural Resources Alternative, Open Space Scenario. Additional soil removal (e.g., under the Revised LUT Values Alternative or the Cleanup to AOC LUT Values Alternative) would result in little additional reduction in risk to human health (see Section S.10.2.5, Comparison of Risk Management and Cost Among Soil Remediation Alternatives text box).
- Soil remediation alternatives present a large range of potential environmental impacts (e.g., in habitat disruption, soil removed, truck trips), but would result in a small difference in residual human health impacts following cleanup. As summarized in the text box in Section S.2.10.5, risk assessments of 19 exposure units in Area IV and the NBZ show that the impacts on a future receptor from chemicals and/or radionuclides in Area IV and the NBZ would be comparable. For the Cleanup to AOC LUT Values Alternative, Cleanup to Revised LUT Values Alternative, and Conservation of Natural Resources Alternative, Residential Scenario, the range of impacts on a hypothetical onsite resident are a similar – the highest calculated cancer risk, 5×10^{-5}, is the same across the three alternatives; the lowest calculated risk of 4×10^{-7}, varies by less than a factor of 10 across the alternatives; and the hazard index for the alternatives falls within the range of 0.05 to 1. Potential impacts on a recreational user as evaluated for the Conservation of Natural Resources Alternative, Open Space Scenario are

also in the same range, with cancer risks ranging from 3×10^{-7} to 1×10^{-5} and the hazard index ranging from 0.01 to 0.3. There would be large differences in other potential impacts during soil remediation, with the largest occurring under the Cleanup to AOC LUT Values Alternative; those under the Cleanup to Revised LUT Values Alternative and Conservation of Natural Resources Alternative would be less. Impacts under the Conservation of Natural Resources Alternative would be the smallest. For example, the amount of land disturbance, which is an indicator of the volume of soil that would be removed and the potential impacts on biological resources, air, traffic, and water use, would be about 90 acres under the Cleanup to AOC LUT Values Alternative; 38 acres under the Cleanup to Revised LUT Values Alternative; 10 acres under the Conservation of Natural Resources Alternative, Residential Scenario; and 9 acres under the Conservation of Natural Resources Alternative, Open Space Scenario.

- The difference in volume estimates for soil remediation between the Cleanup to AOC LUT Values Alternative and the Cleanup to Revised LUT Values Alternative is 691,000 cubic yards (that is, under the Cleanup to AOC LUT Values Alternative, an additional 691,000 cubic yards of soil would be removed from Area IV and the NBZ). Most of the additional soil (690,000 cubic yards) is non-waste soil, that is, soil with concentrations of chemicals and radionuclides that would typically not require remediation. The Conservation of Natural Resources Alternative (both options) represents a risk-based approach that employs an assessment of risk associated with the projected future land use and is typical of what has been applied at other DOE cleanup sites.[44] The volume of soil that would be removed under the Residential Scenario is 52,000 cubic yards and the volume under the Open Space Scenario is 38,200 cubic yards.
- Landfill disposal of 718,000 cubic yards of non-waste soil under the Cleanup to AOC LUT Values Alternative (26-year duration) would result in additional heavy-duty truck trips (46,800 truck round trips for soil removal and 35,100 truck round trips for backfill). Compared to the Cleanup to Revised LUT Values Alternative (6-year duration), this would entail about 20 additional years of truck traffic for hauling soil and backfill; compared to either scenario under the Conservation of Natural Resources Alternative (2-year or less duration), it would entail about 22 additional years. Truck traffic would be most noticeable on Woolsey Canyon Road, the only road into SSFL that is suitable for heavy-duty trucks, where it could increase by up to 8.6 percent (if building removal and soil remediation activities overlapped) and the level of service would change from an A to a B. Because there is more traffic on other roads, DOE's remediation activities would result in only a small percentage increase on those roads. DOE's remediation traffic would be expected to cause delays at the intersection of Woolsey Canyon Road and Valley Circle Boulevard based on an increase of 0.07 to 0.08 in the volume-to-capacity ratio for 16 to 32 daily truck trips. Due to expected increases in traffic as a result of population growth, the levels of service at intersections used by DOE remediation traffic are expected to decline over time. For most intersections, DOE's contribution would not be noticeable, but at the intersection of Woolsey Canyon Road and Valley Circle Boulevard DOE's remediation traffic would be expected to cause delays based on an increase of 0.07 to 0.08 in the volume-to-capacity ratio for 16 to 32 daily truck trips. If DOE, NASA, and Boeing

[44] DOE, in conjunction with its regulators, uses risk assessments that consider the current and potential future use of the land and water resources in making cleanup decisions. The cleanup of the Rocky Flats Plant (DOE, EPA, and CDPHE 2006, DOE 2011b) and the Hanford Site 300 Area (DOE, EPA, and Ecology 2013) are examples of DOE application of risk assessments to site-specific receptors to guide remediation.

were all performing remediation and as many as 96 trucks per day left SSFL, the level of service on more road segments and intersections would be negatively affected.

- Each of the soil remediation action alternatives would leave Area IV and the NBZ safe for the designated future end use as open space. The Conservation of Natural Resources Alternative, Open Space Scenario, would be most consistent with the conservation easements because it minimizes the disturbance of the natural habitat while removing constituents that are evaluated as presenting a potential risk based on the planned future site use as open space. Although the end state of the Cleanup to AOC LUT Values Alternative would be open space, it would be the least consistent with the conservation easements because it would destroy much of the site habitat by removing soil that does not present a risk to future site users. The degree to which the Cleanup to Revised LUT Values Alternative and the Conservation of Natural Resources Alternative, Residential Scenario are consistent with the conservation easements falls between the other two. The No Action Alternative for soil remediation does not meet the intent of the conservation easements because it would leave constituents on site that could pose a risk to a future site user who makes use of the site as open space.
- Implementation of the Cleanup to AOC LUT Values Alternative would result in removal of vegetation and wildlife habitat over about 90 acres, potentially causing mortality and disturbance of wildlife within and adjacent to the affected area. By comparison, the Cleanup to Revised LUT Values Alternative would result in removal of vegetation and wildlife habitat over 38 acres and the Conservation of Natural Resources Alternative over 10 and 9 acres for the Residential Scenario and Open Space Scenario, respectively.
- The soil disturbance caused by remediation would require special measures to accomplish restoration of a self-sustaining native vegetation cover and sources of suitable clean soil for backfill where soil has been removed have not yet been identified. Based on an initial evaluation, DOE has not identified a source of backfill that would meet the AOC LUT values and has notified DTSC. Even if a source of backfill were identified that meets the AOC LUT values, it is uncertain whether the physical, chemical, and biological characteristics of that soil could support successful site restoration using native vegetation, as discussed in Chapter 4, Section 4.5.1. If backfill is substantially different than the soil originally present on site (e.g., the soil pH [acidity]), it may not support vegetation similar to that present in Area IV (e.g., federally and State-listed species such as Braunton's milk-vetch and Santa Susanna tarplant). With implementation of habitat restoration and revegetation measures, as well as measures to reduce or avoid impacts on wildlife as described in Chapter 6, biological impacts would be reduced, but would not be avoided given the degree of habitat loss that would occur through soil removal and the length of time required to restore vegetation, habitat function, and wildlife populations.
- An estimated 1.75 million gallons of water would be required annually to implement any of the soil remediation alternatives. Water use is an important consideration in the comparison of soil remediation alternatives, given the ongoing drought conditions in the State of California. The Cleanup to AOC LUT Values Alternative would last 26 years and use 45.5 million gallons of water, compared to the Cleanup to Revised LUT Values Alternative, which would last about 6 years and use about 10.5 million gallons, and the Conservation of Natural Resources Alternative (both scenarios), which would last about 2 years and use 3.5 million gallons of water.

S.13 References

ASTM (ASTM International), 2013, *Standard Guide for Greener Cleanups*, ASTM E2893-13e1, West Conshohocken, Pennsylvania, November.

Boeing (The Boeing Company), 1999, Memorandum from J. Shao, Radiation Safety, to P. Rutherford, "17th Street Drainage Area Radiation Characterization Surveys and Excavation," January 18.

Boeing (The Boeing Company), 2000, *Area 4020, MARSSIM Final Status Survey Report,* RS-00010, August 31.

Boeing (The Boeing Company), 2008, *Final Consensus Recommendation on a Site Specific Design Storm for Santa Susana Field Laboratory*, Boeing Santa Susana Field Laboratory Stormwater Expert Panel (accessed on June 2, 2015, http://www.boeing.com/assets/pdf/aboutus/environment/santa_susana/ents/ENTS_Expert_Panel_PublicMeeting_050108.pdf), April 30.

Boeing (The Boeing Company), 2015, *Transportation Agreement for the Santa Susana Field Laboratory Ventura County, California Between the Boeing Company (Boeing) and the U.S. Government As Represented by the National Aeronautics and Space Administration (NASA) and the Department of Energy (DOE).*

Boeing (The Boeing Company), 2016, Letter from S. L. Shestag, Director Environment, Santa Susana Site Executive, to S. Kuehl, Supervisor, Third District County of Los Angeles, M. Englander, Los Angeles City Councilman, and F. Pavley, Senator, 27th District Calabasas, "Re: Letter of December 14, 2015 from Supervisor Kuehl, Councilman Englander, and Senator Pavley to Barbara Lee, Director California Department of Toxic Substances Control," February 22.

Burgesser, T., 2015, Memorandum to K. Roberts and J. Wondolleck, *An Evaluation of Chemicals of Natural Origin on Reported Total Petroleum Hydrocarbon Concentrations at the Santa Susana Field Laboratory*, October 8.

California Energy Commission, 2012, *Our Changing Climate 2012 – Vulnerability and Adaptation to the Increasing Risks from Climate Change in California,* A Summary Report on the Third Assessment from the California Climate Center (available at http://www.climatechange.ca.gov/adaptation/third_assessment/), July.

CDC (Centers for Disease Control and Prevention), 2014, *Sources of Valley Fever (Coccidioidomycosis)*, Atlanta, Georgia (accessed on May 5, 2015, http://www.cdc.gov/fungal/diseases/coccidioidomycosis/causes.html), May 14.

CDM Smith, 2015a, *Final RCRA Facility Investigation (RFI) Groundwater Work Plan, Portions of Area IV under DOE Responsibility, Santa Susana Field Laboratory, Ventura, California*, November 9.

CDM Smith, 2015b, *Soil Treatability Studies, Area IV Santa Susana Field Laboratory, Ventura County, California,* Version 2, Denver, Colorado, September.

CDM Smith, 2015c, *Santa Susana Field Laboratory Former Sodium Disposal Facility Groundwater Interim Measures Implementation Plan September 2015 DRAFT,* Denver, Colorado, September.

CDM Smith, 2017, *Draft Chemical Data Summary Report, Santa Susana Field Laboratory, Ventura County, California,* Denver, Colorado, January.

CDM Smith, 2018a, *Draft RCRA Facility Groundwater Remedial Investigation Report, Area IV*, Denver, Colorado, September.

CDM Smith, 2018b, *Draft Groundwater Corrective Measures Study, Area IV,* Denver, Colorado, September.

CDM Smith, 2018c, Technical Memorandum, "CDM Smith Status Report on Former Sodium Disposal Facility Groundwater Interim Measure (FSDF GWIM) – August 2016 Update," August 20.

CEQ (Council on Environmental Quality), 1981, "Memorandum to Agencies: Forty Most Asked Question's Concerning CEQ's National Environmental Policy Act Regulations," 46 FR 18026, Executive Office of the President, Washington, DC, *Federal Register*, Vol. 46, March 23, as amended.

CH2M Hill, 2008, *Group 5 – Central Portion of Areas III and IV, RCRA Facility Investigation Report, Santa Susana Field Laboratory, Ventura County, California,* Volume IX, *RFI Site Reports*, Appendix T, "Systems for Nuclear Auxiliary Power," Draft, November.

CH2M Hill, 2009, *Draft Group 3 Remedial Investigation Report at the Santa Susana Field Laboratory, Ventura County, California,* May.

CRWQCB (California Regional Water Quality Control Board), 2007, Letter from D. Hung, Chief, Watershed Regulatory Section, to T. Gallacher, Director, SSFL Safety, Health and Environmental Affairs, The Boeing Company, "National Pollutant Discharge Elimination System Permit (NPDES) (Order No. R4-2007-0055 and Cease and Desist Order (Order No. R4-2007-0056) for the Boeing Company, Santa Susana Field Laboratory, Canoga Park, NPDES No. CA0001309, CI No. 6027," November.

DOE (U.S. Department of Energy), 2003, *Final Environmental Assessment for Cleanup and Closure of the Energy Technology Engineering Center*, DOE/EA-1345, National Nuclear Security Administration Service Center, Oakland, California (available at http://www.etec.energy.gov/Regulation/ RegDocs/ETECEA.pdf), March.

DOE (U.S. Department of Energy), 2009, *Scoping Comment Responses for the Environmental Impact Statement for Remediation of Area IV of the Santa Susana Field Laboratory* (available at http://www.etec.energy.gov/EIS/Documents/SSFL%20Area%20IV%20Final%20Scoping%20CRD.pdf), September 28.

DOE (U.S. Department of Energy), 2010, *Community Involvement Plan Area IV Santa Susana Field Laboratory,* prepared by CDM Smith and Science Applications International Corporation (available at http://www.etec.energy.gov/EIS/Documents/SSFL_Area_IV_Community_ Involvement_Plan_2-26-10.pdf), February.

DOE (U.S. Department of Energy), 2011a, *DOE O 458.1, Radiation Protection of the Public and the Environment*, Change 3, Administrative Change (January 15, 2013), Office of Health, Safety and Security, Washington, DC.

DOE (U.S. Department of Energy), 2011b, *Corrective Action Decision/Record of Decision Amendment for Rocky Flats Plant (USDOE) Central Operable Unit, Jefferson and Boulder Counties, Colorado*, September 19.

DOE (U.S. Department of Energy), 2014, *Environmental Impact Statement for Remediation of Area IV and the Northern Buffer Zone of the Santa Susana Field Laboratory Final Scoping Summary Report* (available at http://www.etec.energy.gov/Library/Cleanup_and_Characterization/EIS/Final%20Scoping%20Summary%20Report%20SSFL%20EIS.pdf), August 6.

DOE (U.S. Department of Energy), 2015, *Executive Order 13693 – Planning for Federal Sustainability in the Next Decade*, Memorandum for Distribution from M. Gilbertson, Deputy Assistant Secretary for Site Restoration, Washington, DC, September 10.

DOE (U.S. Department of Energy), 2016, Letter from J. Jones to R. Leclerc, DTSC Division Chief, Brownfield & Environmental Restoration Program, "Identification of Backfill Soils Available to be used by the Department of Energy at the Santa Susana Field Laboratory," December 21.

DOE (U.S. Department of Energy), 2017, Letter from M. Gilbertson, Acting Associate Principal Deputy Assistant Secretary for Regulatory and Policy Affairs, to Ms. B. Lee, Director, Department of Toxic Substances Control, Re: meeting request to discuss mutual acknowledgement that the comprehensive cleanup of soils and groundwater in Area IV by 2017 will not occur, June 29.

DOE (U.S. Department of Energy), 2018, *Soil Remediation Excavation Rates Review and Recommendation @ Energy Technology Engineering Center (ETEC), Ventura County, CA*, Environmental Management Consolidated Business Center, Office of Cost Estimating, May 1.

DOE, EPA, and CDPHE (U.S. Department of Energy, U.S. Environmental Protection Agency, and Colorado Department of Public Health and Environment), 2006, *Corrective Action Decision/Record of Decision for Rocky Flats Plant (UDOE) Peripheral Operable Unit and Central Operable Unit, Jefferson and Boulder Counties, Colorado*, September.

DOE, EPA, and Ecology (U.S. Department of Energy, U.S. Environmental Protection Agency, and Washington State Department of Ecology), 2013, *Hanford Site 300 Area Record of Decision for 300-FF-2 and 300-FF-5, and Record of Decision Amendment for 300-FF-1*, November.

DTSC (State of California Department of Toxic Substances Control), 2007, *The State of California Environmental Protection Agency, Department of Toxic Substances Control, The Boeing Company, the National Aeronautics and Space Administration, and the United States Department of Energy, In the Matter of: Santa Susana Field Laboratory, Simi Hills, Ventura County, California, Consent Order for Corrective Action*, Docket No. P3-07/08-003, Health and Safety Code Section 25187, August 16.

DTSC (State of California Department of Toxic Substances Control), 2009, *Interim Advisory for Green Remediation* (available at http://www.dtsc.ca.gov/OMF/upload/GRT_Draft_-Advisory_-20091217_ac1.pdf), December.

DTSC (State of California State of California Department of Toxic Substances Control), 2010a, *The State of California Environmental Protection Agency, Department of Toxic Substances Control and the United States Department of Energy, In the Matter of: Santa Susana Field Laboratory, Simi Hills, Ventura County, California, Administrative Order on Consent for Remedial Action*, Docket No. HSA-CO 10/11-037, Health and Safety Code Sections 25355.5(a)(1)(B), 58009 and 58010, December 6.

DTSC (State of California Department of Toxic Substances Control), 2010b, *The State of California Environmental Protection Agency, Department of Toxic Substances Control and the United States National Aeronautics and Space Administration, In the Matter of Santa Susana Field Laboratory, Simi Hills, Ventura County, California, Administrative Order on Consent for Remedial Action*, Docket No. HSA-CO 10/11-038, Health and Safety Code Sections 25355.5(a)(1)(B), 58009 and 58010, September 3.

DTSC (State of California Department of Toxic Substances Control), 2013a, *Draft Provisional Radiological Look-Up Table Values* (available at http://www.dtsc-ssfl.com/files/lib_look-uptables/radiological/66513_65861_Draft_Provisional_Radiological_Look-Up_Table_Values_1-30-13.pdf), January.

DTSC (State of California Department of Toxic Substances Control), 2013b, *Chemical Look-Up Table Technical Memorandum, Santa Susana Field Laboratory, Ventura, California*, June 11.

DTSC (California Department of Toxic Substances Control), 2017, *Draft Program Environmental Impact Report for the Santa Susana Field Laboratory, Ventura County, California*, SCH# 2013111068, September.

DTSC (California Department of Toxic Substances Control), 2018, Total Petroleum Hydrocarbons Fact Sheet, available at https://www.dtsc.ca.gov/SiteCleanup/Santa_Susana_Field_Lab/ssfl_whats_new.cfm.

EPA (U.S. Environmental Protection Agency), 2009, *Principles for Greener Cleanups*, Office of Solid Waste and Emergency Response, Washington, DC, August 27.

EPA (U.S. Environmental Protection Agency), 2015a, "Integrated Risk Information System" (available at http://www2.epa.gov/iris).

EPA (U.S. Environmental Protection Agency), 2015b, "Regional Screening Levels (RSLs) – Generic Tables (November 2015)," November.

Geosyntec, 2012, *2012 BMP Plan Addendum Santa Susana Site, Ventura County, California*, prepared with the Santa Susana Site Surface Water Expert Panel, Los Angeles, California, September 28.

Haley and Aldrich (Haley & Aldrich, Inc.), 2010, *Site-Wide Water Quality Sampling and Analysis Plan, Santa Susana Field Laboratory, Ventura County, California*, Revision 1, Tucson, Arizona, December.

HESIS (Hazard Evaluation System and Information Service), 2013, Fact sheet: *Preventing Work-Related Coccidioidomycosis (Valley Fever)*, California Department of Public Health, California Department of Industrial Relations, Richmond, California (available at https://www.cdph.ca.gov/programs/hesis/Documents/CocciFact.pdf), June.

HGL (HydroGeoLogic, Inc.), 2011, *Final Radiological Background Study Report, Santa Susana Field Laboratory, Ventura County, California*, prepared for the U.S. Environmental Protection Agency, Region 9, October.

HGL (HydroGeoLogic, Inc.), 2012a, *Final Radiological Characterization of Soils, Area IV and the Northern Buffer Zone, Area IV Radiological Study, Santa Susana Field Laboratory, Ventura County, California*, prepared for the U.S. Environmental Protection Agency, Region 9, December.

HGL (HydroGeoLogic, Inc.), 2012b, *Final Technical Memorandum Look-up Table Recommendations, Santa Susana Field Laboratory Area IV Radiological Study*, prepared for the U.S. Environmental Protection Agency, Region 9, November 27.

HGL (HydroGeoLogic, Inc.), 2012c, *Final Historical Site Assessment, Santa Susana Field Laboratory Site, Area IV Radiological Study, Ventura County, California*, prepared for the U.S. Environmental Protection Agency, Region 9, Ballston Lake, New York, October.

HGL (HydroGeoLogic, Inc.), 2012d, *Final Groundwater Report, Area IV Radiological Study*, *Santa Susana Field Laboratory, Ventura County, Californi*a, prepared for the U.S. Environmental Protection Agency, Region 9, July 24.

HGL (HydroGeoLogic, Inc.), 2012e, *Final Gamma Radiation Scanning Report, Area IV Radiological Study, Santa Susana Field Laboratory, Ventura County, California*, prepared for the U.S. Environmental Protection Agency, Region 9, October 17.

ICRP (International Commission on Radiological Protection), 1977, *Recommendations of the International Commission on Radiological Protection*, ICRP Publication 26, Annals of the ICRP, Vol. 1 (3).

ICRP (International Commission on Radiological Protection), 1983, *Cost-Benefit Analysis in the Optimization of Radiation Protection*, ICRP Publication 37, Annals of the ICRP, Vol. 10 No 2/3.

IPCC (Intergovernmental Panel on Climate Change), 2013, *Climate Change 2013 - The Physical Science Basis,* Working Group I Contribution to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge University Press, New York, New York (available at http://www.climatechange2013.org/images/report/WG1AR5_ALL_FINAL.pdf).

LA (City of Los Angeles), 2006, *L.A. CEQA Thresholds Guide, Your Resource for Preparing CEQA Analyses in Los Angeles*.

LADOT (City of Los Angeles, Department of Transportation), 2016, *Transportation Impacts Study Guides*, December.

Matsumoto, M. R., and J. Martin, 2015, *Summary Report: Santa Susana Field Laboratory (SSFL) Soil Partitioning Treatability Study*, University of California, Riverside, California, May.

MWH (MWH Americas, Inc.), 2006, *Group 6 – Northeastern Portion of Area IV RCRA Facility Investigation Report, Santa Susana Field Laboratory, Ventura County, California*, Vol. 1, Arcadia, California, September.

MWH (MWH Americas, Inc.), 2007, *Group 8 – Western Portion of Area IV, RCRA Facility Investigation Report, Santa Susana Field Laboratory, Ventura County, California*, Arcadia, California, September.

MWH (MWH Americas, Inc.), 2009, *Group 7 – Northern Portion of Area IV RCRA Facility Investigation Report, Santa Susana Field Laboratory, Ventura County, California*, Vol. 1, Arcadia, California, June.

MWH (MWH Americas, Inc.), 2012, *Stormwater Pollution Prevention Plan for the Santa Susana Site*, Revision 7, prepared for The Boeing Company, Santa Susana Site, Arcadia, California, October.

MWH (MWH Americas, Inc.), 2014, *Final Standardized Risk Assessment Methodology Revision 2 Addendum, Santa Susana Field Laboratory, Ventura County, California*, August.

NASA (National Aeronautics and Space Administration), 2017, Letter from P. Zorba, NASA SSFL Project Director, to J. Jones, U.S. Department of Energy, *Clarification of NASA Backfill Comment on DOE Draft Environmental Impact Statement*, August 8.

Nelson, Y. M., K. Croyle, M. Billings, and M. Poltorak, 2015a, *Natural Attenuation Study for the Santa Susana Field Laboratory: Final Report*, California Polytechnic State University, San Luis Obispo, California, April 27.

Nelson, Y. M., M. Poltorak, M. Curto, P. Waldburger, A. Koivunen, and D. Dowd, 2015b, *Phytoremediation Study for the Santa Susana Field Laboratory Final Report*, California Polytechnic State University, San Luis Obispo, California, April 16.

Nelson, Y. M., M. Billings, K. Croyle, C. Kitts, and A. Hamrick, 2015c, *Bioremediation Study for the Santa Susana Field Laboratory Final Report*, California Polytechnic State University, San Luis Obispo, California, May 7.

Nelson, Y. M., S. Cronin, K. Cochran, and A. Varni, 2015d, *Chemical Characterization of Residual Fuel Hydrocarbons in Soils at the Santa Susana Field Laboratory, Final Report*, California Polytechnic State University, San Luis Obispo, California, July 31.

North Wind (North Wind Incorporated), 2014, Personal communication (email) from B. Frazee to S. Jennings U.S. Department of Energy, "ETEC D&D Waste Quantity Estimates," November 10.

North Wind (North Wind Incorporated), 2018, *Report on Quarterly Groundwater Monitoring, Area IV, First Quarter 2018, Santa Susana Field Laboratory, Ventura County, California*, June.

P2 Solutions, 2009, *Report on Community Interviews, Community Concerns and Preferences for Public Participation in Cleanup of Area IV, Santa Susana Field Laboratory* (available at http://www.etec.energy.gov/EIS/Documents/Community_Interviews.pdf), Idaho Falls, Idaho, February.

Santa Ynez Band of Chumash Indians, 2014, Personal communication (email) from S. Cohen, Government and Legal Specialist to S. Jennings, U.S. Department of Energy, "Santa Ynez Chumash Comment opposing restriction of EIS alternatives," March 12.

SFWQCB (San Francisco Bay Regional Water Quality Control Board), 2013, *2013 Tier 1 ESLs,* California Environmental Protection Agency, Water Boards, Oakland, California, December.

State of California 2018, "Governor Brown Signs Legislation Establishing Statewide Water Efficiency Goals," Office of the Governor, May 31.

URS (URS Corporation), 2012, *Final Chemical Soil Background Study Report*, *Santa Susana Field Laboratory, Ventura County, California*, prepared for the California Environmental Protection Agency, Department of Toxic Substances Control, Los Angeles, California, December.

USGCRP (U.S. Global Change Research Program), 2014, *Climate Change Impacts in the United States*, U.S. National Climate Assessment, Washington, DC (available at http://www.globalchange.gov/nca3-downloads-materials), May.

Ventura County (Ventura County Register of Deeds), 2017a, Grant Deed of Conservation Easement and Agreement between The Boeing Company and North American Land Trust, recorded in Ventura County (recording number 20170424-00053180-0 1/41), April 24.

Ventura County (Ventura County Register of Deeds), 2017b, Grant Deed of Conservation Easement and Agreement between The Boeing Company and North American Land Trust, recorded in Ventura County (recording number 20171117-00149829-0 1/51), November 15.